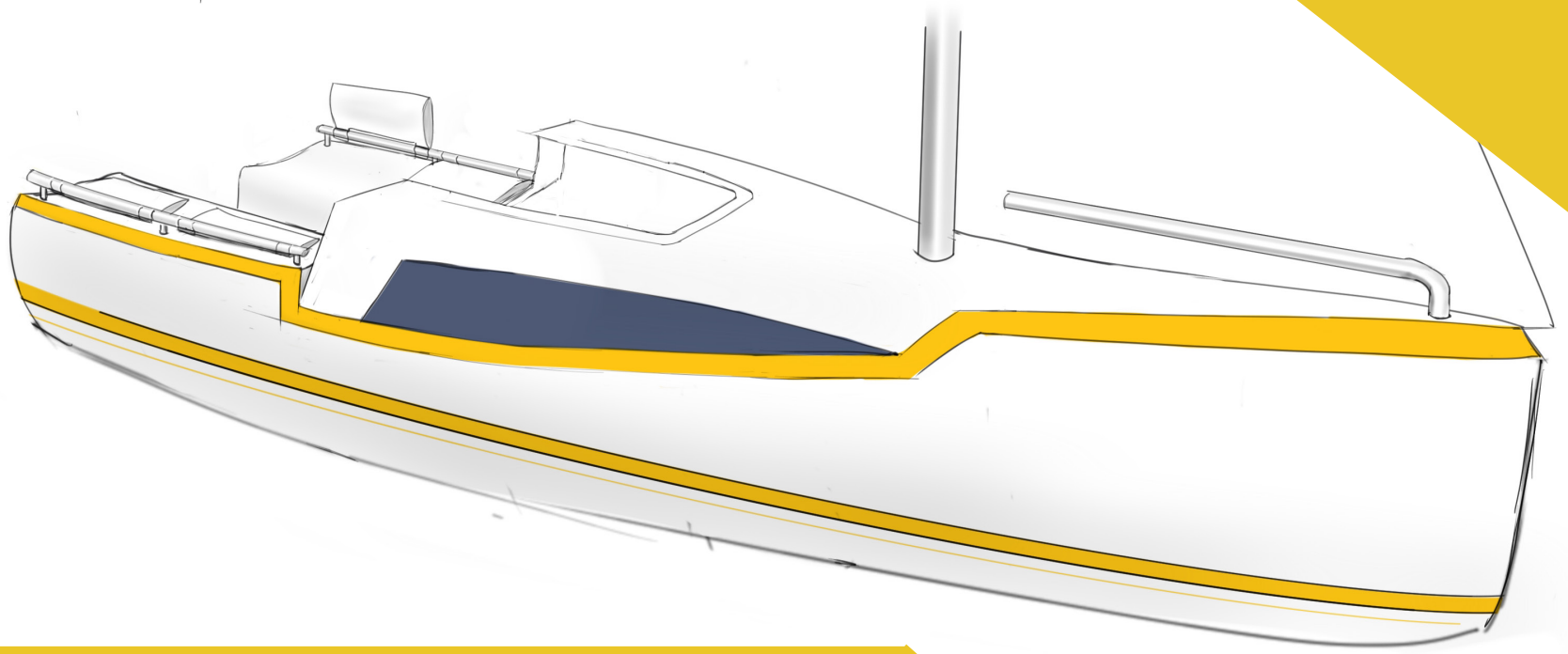
Sailing Yacht Design

For Improvement of Space Perception



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Report Bachelor Graduation Project Industrial Design

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Fig. 1 Drawing Final design

Content

Summary

This report describes the design process of a sailing yacht with improvement of the space perception. The assignment is carried out at yacht designer Satellite Yacht Design. The company would like to introduce innovative ideas to a rather monotonous market. Therefore they offered an internship to a non-yacht designer.

In preliminary talks to the contract, it was determined that the focus of the assignment would be on small yachts (7 to 9 m) and on the perception of space on board. Before the design phase, several analyzes have been made to find out what is currently on the market and what target groups are interesting to focus on with this new design. Three target groups are most interesting: Rental, 50+ and wealthy thirties. A list of wishes and demands is established for the target groups. It is being substantiated by a questionnaire and an interview with a yacht builder. At this point it became clear these target groups don't have enough overlap to be united in one design.

The rental is disengaged because the group is too complicated to focus on and less suited for innovations. The design is decided to be partly modular, buying this yacht is like buying a car: buyers get to pick colors and features. A design brief is drawn from the demands for the remaining target groups. The 4 goals of the redesign are: improvement of space perception, ease of operation, appearance and comfort. Several concepts for the interior design are generated in several areas, redesign of: the galley, sitting in- and outside and opening. These concepts are valued and chosen based on the 4 goals.

Suitable parts and systems are designed for the interior design. When the interior design is established it automatically generates demands for the exterior design. The next step is designing the exterior. After this process styling of the practical design is done, the rental group is being re-engaged because adapting the design for rental turned out to be fairly easy.

The design is well suited for the purpose it is designed for, not all parts are new but the innovations concern several important areas of the boat.

Introduction

This Bachelor's assignment is done on behalf of Satellite Yacht Design, this company designs yachts for the consumer market. This business is a sole proprietorship, Kees van de Stadt specializes in designing sports yachts. The production of these yachts is outsourced. The priorities in the design of the yachts are: safety, performance and comfort. The company wants to contribute to innovations in the field and respond to the changing market and customer needs. The company wants to gain a competitive advantage. The designs of Satellite Yacht Design were mainly one-off built. In recent years the designs for the Chinese market have been more series construction. The main actor in this case, the client, has certain requirements and needs that will be taken into account.

In recent years, we see the trend of "glamping" (glamorous camping). This is camping with a little extra luxury. People with above-average income want to be close to nature but still enjoy the amenities they're accustomed to. Even in the world of boating it has its influence. In recent decades, the sloop has been a trend in boating. This is a fast but comfortable open motorboat. In the design of small sailing yachts, little has been done with this trend so far. Developments with regard to this trend could lead to an innovation. The user experience of the new yacht will be more comfortable, without compromising on safety or performance. This could be done by making use of the available space on board differently.

The objective of this assignment is to create a concept design of a yacht, which improves the use of space on board, from the perspective of ergonomics and user experience. This will be done by first analyzing the current operating situation and the desired user experience based on scenarios, which are drawn up based on situation variables. The design will be developed into a full concept and presented in renders and drawings.
In chapter 1 you find a market analysis to see what kind of space perceptive ideas are on the market, not only in yacht design but in caravan design as well. Next the optional target groups with their main wishes and demands are explained in chapter 2. The usage situations are investigated through scenarios and mood boards for the target groups were made. In chapter 3 the different modules are explained, options and choices for the facilities and equipment on board. The modules are coupled to the target groups in chapter 4 and this coupling is reviewed by means of a questionnaire and the help from a specialist from a shipyard and selling company.

A competition analysis is done in chapter 5 and a design brief is drawn up in consultation of the contracting in chapter 6. In chapter 7 for every target group a styling document is made so later on the styling of the concepts can be adjusted accordingly. In chapter 8 and 9 ideation and concept generation for the interior is done. When the interior design is established in chapter 10, it automatically gives demands for the exterior design in respect of placement of windows, ceiling height, opening and so on. The right modules are chosen and matching parts are selected. In chapter 11 ideation for the exterior design is done and in chapter 12 the final exterior design is presented with adjusted styling according to the styling from chapter 7. In chapter 13 the conclusion and recommendations can be found.

More information about some subjects is available in the appendices. the planning and the plan of approach for this project can be found in the appendices A & B.

1 First explorations

In this market analysis is looked at different yacht designs in which ideas of usage of space were innovative. The yachts differ in size and are therefore not all relevant for this assignment, but it is an interesting overview of the current ideas.

Something interesting for space concepts is a deck saloon. This gives a feeling of a motor yacht, because you have a nice view from the cabin, and you have the possibility to steer inside. The disadvantage is that when sitting in the cockpit, you cannot see over the superstructure. This concept is more applicable for larger sailing yachts. As you can see in fig. 1.1, the deck saloon has to be below the boom. In a smaller sailing boat you`ll not be able to create headroom underneath the boom, see fig. 1.3.

Another interesting concept is a forecastle deck, this gives much more space inside. A forecastledeck is an almost vertical sidedeck, resulting in a walking area higher than usual, so there is more headroom in the cabin. The Fox 22, shown in fig. 1.2, is a good example of a forecastle deck, that can be compared to the deck height in fig. 1.3.

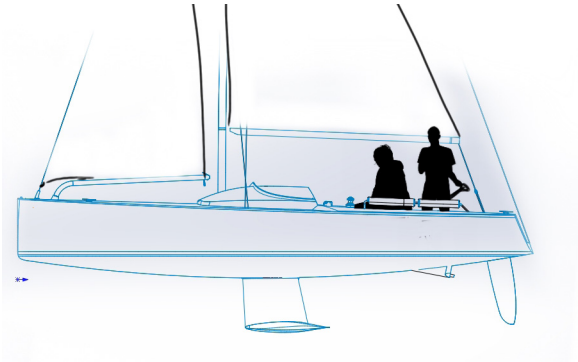

Fig. 1.3 Normal proportioned sailing yacht

Fig. 1.1 Moody deck saloon

Fig. 1.2 Forecastle deck on Fox 22

In the 90's the Dehler Red-riding-hoods were built, see fig. 1.4. These 18 foot boats have a small cabin, which could be extended by a tent which was hidden in the red cap. It was a very popular design, a few years ago the Dehler 18 was redesigned and is now called Varianta 18. In the new design they let go of the idea with the tent. Because of modernization, nowadays people don't want to have the hassle of building a tent on such a small boat(18ft), so they converted it to a daysailor instead. Extending the inside space by means of a tent is an interesting idea for the perception of space, because of the double usage. Attention needs to be paid to the design and the userfriendliness.

Fig. 1.4 Dehler Red-riding hood

In the Elan 210 a new idea for storage was used: in the interior is a rail, on which you can hang bags, these bags come with the boat. You can pack the bags at home and hang them inside the boat. This makes the design flexible. In other boats you have to unpack your bags to make optimal use of storage room. Unfortunately it looks a bit messy and cheap as you can see in fig.1.5. This design is currently in the market. Storage space is an interesting focus point aboard a sailing yacht.

Fig. 1.5 Elan 210 interior

Some innovative designs are focused on the energy balance and ecology which can be a big modernization. Wubbo Ockels designed the "Ecolution" and Peter Hoefnagels, a Dutch writer of sailing books, designed the "Duurzaam Yacht". Another interesting design is the "Hreko". These designs differ in size. The "Ecolution" (fig.1.6A) is a super yacht. The most important renewal is the redesigned set of sails. The "Duurzaam Yacht" (fig.1.6B) is a very classic design but is technologically advanced. The "Hreko" (fig.1.6C) is a very different design. It is designed with only the practical considerations of one person. It has some nice innovative ideas. The ecology is a point to consider in the design of a new yacht.

Fig. 1.6 A: Ecolution B: Duurzaam jacht C: Hreko

Concept Cars & Caravans

Concept cars are investigated because of the styling. The newer concept cars reflect the style of modern vehicles. The appearance for the design in this assignment should reflect on that.

In concept cars we see many different styles. In this assignment a choice is being made based on the target group. in fig. 1.7 some very different styling concepts can be seen. the cars are used as a first inspiration for the styling of the sailing yacht. Also in interiors the concept cars differ quite a lot, see fig. 1.8. The target group and the usage of the

1. Toyota concept car

2. Lamborghini Ferruccio concept car

3. Corvette Stingray

4. BMW I3

5. Kia KV 7

6. Nissan NUVU

Fig. 1.7 concept cars designs

car decide the appearance as well. This influences the space perception aboard. When looking at nr. 5 and 6 respectively the KIA KV7 and the nissan NUVU, we can see a different placement of seats as usual, but in a totaly different styling. In chapter 7 styling is referred back to the concept cars.

Fig. 1.8 concept cars interior

In concept caravans and campers we can see some interesting developments as well. In fig.1.9 the Caravisio from Knaus can be seen. This is a camper with a new layout instead of the normal layout: a lounge bench is placed and a modern designed kitchen is used.

In fig. 1.10 the Colim caravan concept can be seen. Here the shapes and layout are renewed with a very basic design. The styling resembles the interior of the Nissan NUVU but this design includes livingspace.

In fig.1.11 we see the Leichtbau Studie Travelino from Knaus. This a more minimalistic design with a lot less space, It has a more common layout but the sliding kitchen is interesting. Cooking can be done outside or under the awning.

In fig.1.12 we see the camper bus Topos sail caddy from Volkswagen. This caddy has hatches on the roof to create a sun deck and has a ladder on the back.

Fig. 1.9 Caravisio Knaus

Fig. 1.10 colim caravan

Fig. 1.11 leichtbau studie travelino Knaus

Fig. 1.12 Topos sail caddy VW

2 Target groups

Target groups
Below the target audience groups are explained and a first sifting was done with the table below. this table is being composed in consult with the company.

- Rental: very basic and robust sailing boat, price is most important.
- Wealthy thirties: a (trailerable) sportive sailing boat, appearance is important.
- People with children: a sailing boat with lots of storage space and very versatile in usage.
- 50+: a (trailerable) sportive sailing boat, comfort is important.
- Couples with 1 sailingfan: a sportive sailing boat, solo sailing is important
- Environmental aware: A sailing boat, self sufficiency and ecology are important.

	Rental	Wealthy thirties	People with children	50 +	Couples with 1 sailing fan	Environment aware
Trim (sporty)	+	++	+	+	+	-
Design	--	++	+	++	++	-
price	++	--	++	-	+	+
Ease of operation	++	-	-	++	+	+
Luxury	--	+	+	++	++	--
Less effort	-	+	-	++	+	--
Comfort	--	-	-	++	++	--
cleanability	++	-	--	+	+	--
Long life	++	++	+	+	0	++
environmental	--	+	-	-	-	++
solo	--	+	0	+	++	0
Many beds	++	-	++	-	-	--
trailerable	--	++	+	+	+	--
	Rental	Wealthy thirties	People with children	50 +	Couples with 1 sailing fan	Environment aware

--: no benefits
-
0
+
++: many benefits

Since the new design is focusing on comfort and luxury the environmental aware are less interesting they are excluded from the assignment. the rental doesn`t value luxury high either but is taken into account because of the size of the target group.

The couples with 1 sailing fan are a hard target group since they dont have a common taste or desire. They can be partially assigned to 50+ and partially to wealthy thirties.

Scenario`s

Scenario 50+

John has been a fanatic sailor his whole life. Elisa, his wife, used to like it a lot too and always went along sailing in the weekends. For the past years she started to be frightened of tilting, and she doesn't always want to join John on his sailing trips. Therefore John is looking for a new ship, a ship he can handle alone. He would prefer a ship that is trailerable so he can park it by his house and easily take the boat on a holiday to go sailing.

John uses the ship mainly in the weekends for a daytrip and in holidays together with his son or friend for longer periods. He used to go on evening trips after a workday but since his wife doesn't want to join it doesn't happen so often anymore. When Elisa is joining him on a trip she likes to have a comfortable seat and a proper bed, because she gets a backache.

For the weekends John likes to sail on the Frisian lakes and when his son is joining him they will also go on coastal waters. Last year he and Elisa took the ship to Sweden and next year he wants to go to the Baltic Sea. John is a real sailor and likes to go sailing in all kinds of weather but preferably good weather or strong winds. He doesn't go sailing alone with strong winds he will take his son or friend with him. And when they are trapped in bad weather it is never very far to a harbor. Because John sails alone a lot he would like to have a good view over the cabin. On board there are two beds and a small galley to heat some soup or make some coffee. When on a trip they take berth mostly in marinas, and go out for dinner. For electronics he doesn't need much, something to charge the phones, play some music and drink a cold beer is just fine . On board there is no hot water but they would like a heater, to warm up after a cold and wet trip.

They want a ship with good sailing properties, for appearance it is modern but not too radical, they still want it to be a sailing boat. This target group has a practical approach and doesn't want to pay too much; they don't need frills when it has no purpose. They are sailors and want a good set of sails, with a gennaker and a square top mainsail. This group wants an inboard motor for reliability they will weigh the choice of an electric or diesel motor, for cost, environment and reliability.

Current market: Winner 8 (fig. 2.1)

The moodboard for 50+ can be seen on the right page.

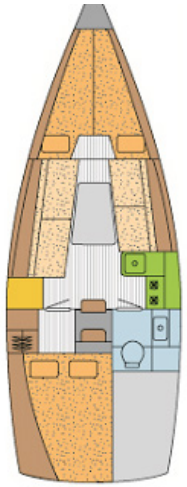

Fig. 2.1 Winner 8

Next page: Fig. 2.2 Collage 50+


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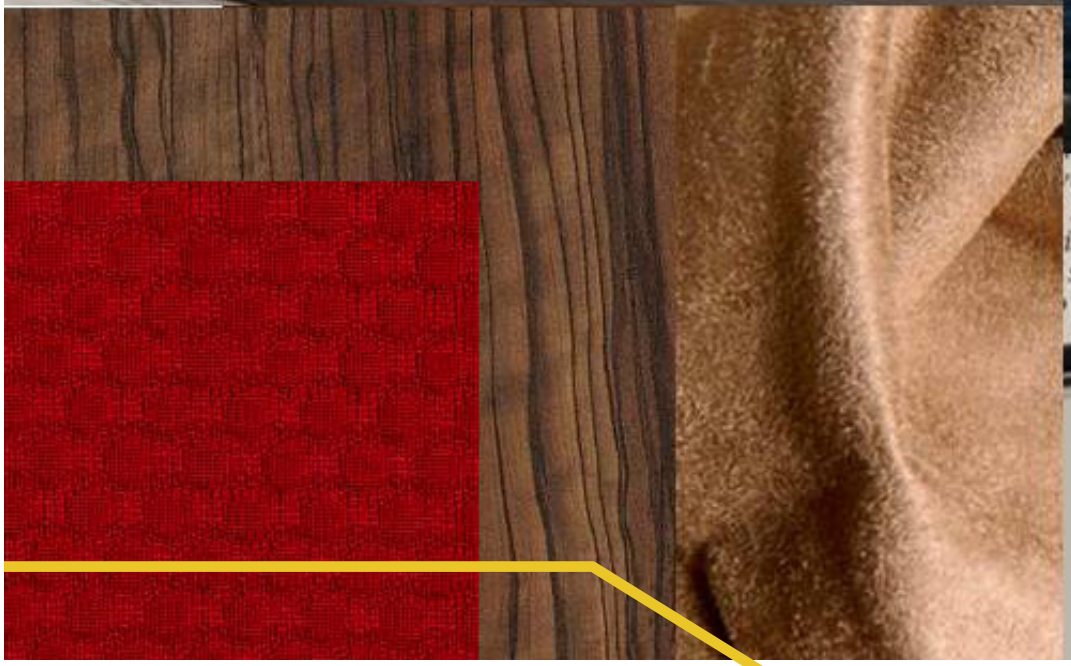


Scenario Rental

I

Laura, Jenny and Martha are very good friends and they are going on a holiday together. They are 23 years old and just finished college. Laura is the only one with sailing experience. They are renting a sailing boat for a week. They stay on the inland waters to have fun and swim. Fortunately the weather is good so they can go swimming a lot. They don't have much to spend, so they like to cook their own dinner. They would love to have a boat with all kinds of assets but they don't have money to pay for it. So they will go for less luxury. They only sail in good weather conditions because they are inexperienced and are enjoying their holiday, they want a lot of storage room for all their holiday stuff. They like the boat to look good but it is no priority.

II

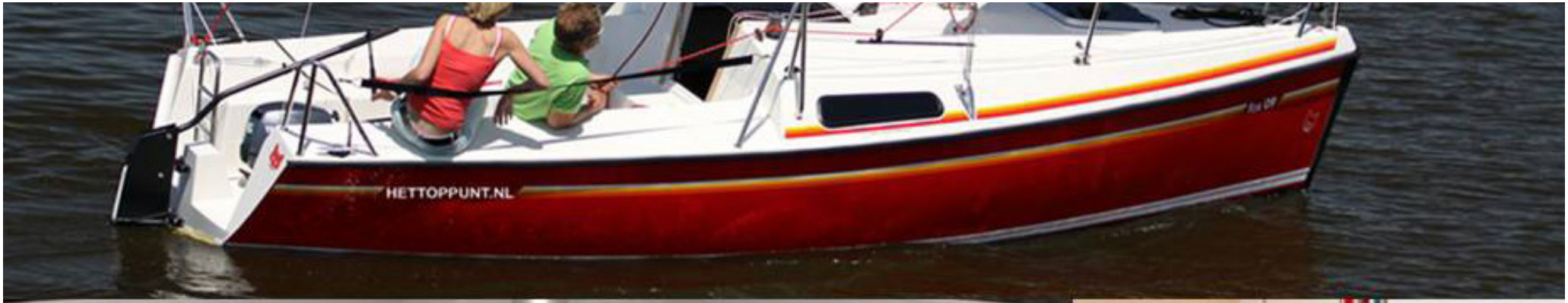
Michael and his dad Frederick are sailors but don't really have time for their own ship. They rent a boat to sail inshore; they want to use the boat in more extreme conditions. Micheal and Frederick want good sailing gear and are willing to spend a bit more on the rent of a better boat. For overnight they like to have a little comfort, they cook their own dinner and like a heater for after a cold sailing day. The sailing properties are very important because they rent the boat to go sailing.

This target group has a wide variety of wishes and demands; therefore they are hard to please.

Current market: fox 22 (fig. 2.3)
the moodboard for rental can be seen on the right page.

Fig. 2.3 Fox 22

Next page: Fig. 2.4 Collage Rental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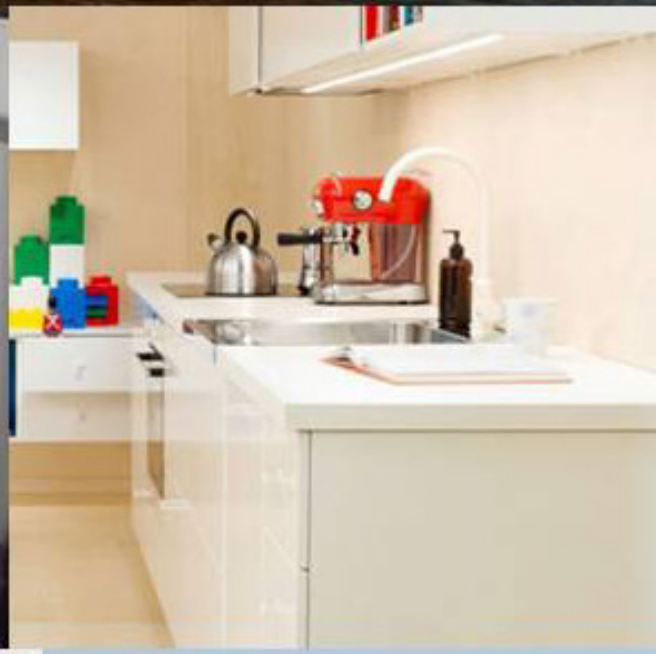
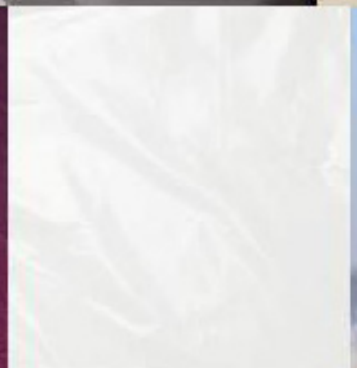
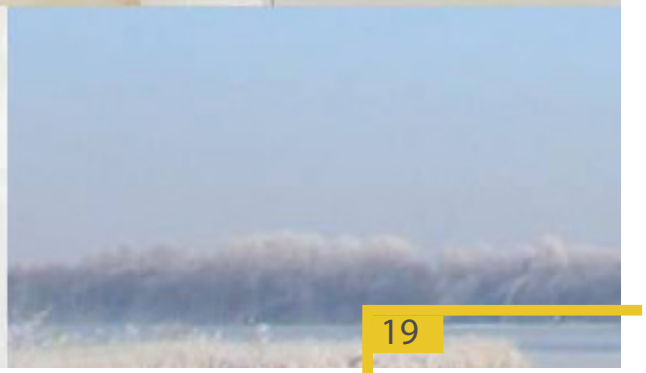






Scenario Young Couples with Children

Dennis and Melisa with their eight year old daughter Zoë want their own sailing boat. They know about sailing but don't have much money for their own boat. They would love to sail coastal waters and also inland. They travel to Terschelling in their holiday when the weather is beautiful. After a few days they have to go back but the weather has changed. They pull up the spray hood; they love to sail fast again but are a bit worried about Zoë. Safety is an important issue. On Terschelling they like to cook their own meal but will also go out for dinner once or twice. They use the harbors facilities but have their own little toilet for on the way on board. There are at least three beds. In the winter, Dennis does the maintenance himself and they park the boat near the house so they don't have mooring fees.
This target group is not that interesting because of the lack of money; they will probably choose a much cheaper second hand boat. No mood board was made for this target group; it will be disengaged in the project from now on.

Scenario Wealthy Thirties

Tim is 27 years old. He got a good job right after college and has no kids. He is an accountant and currently bachelor. Tim is looking for a good-looking sailing boat to take his family and friends on a trip. He is looking for a luxury appearance and wants to create a lounge feeling. He wants the newest gadgets to show off; he would like a wifi system to play his music. He wants a boat with a sporty look which he can sail by his own. When cruising the waters he likes to stand out and be the fastest boat around. In summer the boat is in a luxurious harbor. In winter the maintenance is done by a ship yard because Tim has the money to have it done and no time to do it himself.

The sailing boat should be easy to operate, with a spacious cockpit. It should have all kind of facilities, a cooler for cold drinks, a separate toilet, maybe even an espresso machine or ice cube machine, Tim doesn't intend to cook on board. Tim wants to do sportive sailing and therefore has a complete set of sails with a square top mainsail, his rigging is carbon. The berth is a harbor on the Ijsselmeer Lake and occasionally he sails on the North Sea. Tim wants an exclusive outstanding boat; he wants attention to be paid to all details. He wants an inboard electromotor, because of the sound and view. He uses his motor mainly to go in and out the harbor. Tim doesn't need a heater or hot water because he won't use it in his normal use, but he does want advanced electronics, to charge his cell phone and have a wireless sound system. He wants practical sailing equipment as long as it looks cool for instance the spray hood should look fancy enough or he will not use it. The boat has sleeping accommodation but Tim isn't going to use it very often because he has very little time and a lot of other hobbies. When he goes aboard he wants to put his stuff somewhere so that the ship looks nice and clean.
Current market: "Saffier 26" (fig. 2.5) the moodboard for wealty thirties can be seen on the right page.

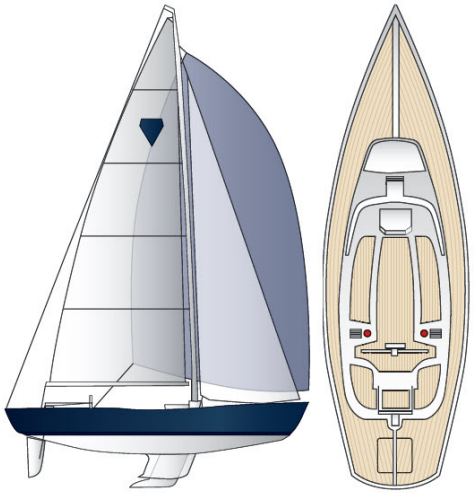
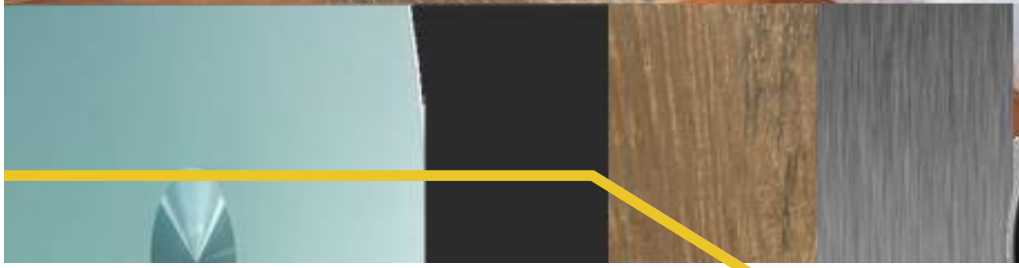


Fig. 2.5 Saffier 26

Next page: Fig. 2.6 Collage wealthy Thirties



3 Modules

Size: The length-over-all is the length of the ship, in this project it has been set at 7 to 9 meter. The beam is the width of the ship, for trailerable yachts the rules give a maximum of 2.55 meter (EVO). The draft is how deep the boat is from the water level. This is mainly important in inland waters because there are shallow waters. On bigger waters it is good to have a big draft for stability.

Engine: In engines there is a choice between inboard and outboard motor; there are a few reasons for both choices:
- Outboard gives more noise
+ Outboard steers directly
+ Outboard is easier in terms of maintenance
- Outboard is vulnerable
+ Inboard gives better weight distribution
+ Inboard takes no visible space

Fuel: diesel/petrol or electric
With inboard you see a lot of diesel engines. A diesel is cheaper in fuel, but the engine is more expensive. With outboard the engine is mostly a petrol. In addition, you can also have an electric motor both inboard and outboard. This kind of electric propulsion can only be used for short stretches because of the capacity of the batteries.

Mainsail: A square top mainsail as seen in fig. 3.1, is an option, this means that the mainsail does not have the standard triangular form but that it is better formed by means of slats, the shape is more foil like and therefore gives better performance. It is also more expensive. In sails you can also choose for different materials you have the standard Dacron sails, but for better performance and a square top mainsail you need laminate sails, this material is heavier but stronger.

Rigging:There is a choice for a carbon mast or regular aluminum, a carbon mast is easier to trim because it is more flexible. Also it is lightweight and therefore gives better performance, it is also more expensive.

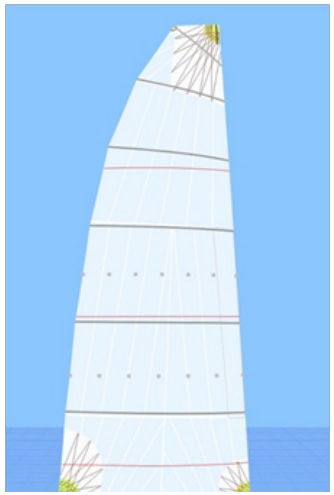


Fig. 3.1 Square top mainsail

Jib(frontsail): A self tacking jib is mostly used because it is easier, it doesn't require any interference from the sailor(it will set itself when tacking), and is therefore most used for solo sailing. The clew point of the jib is mounted on a rail over the foredeck see fig. 3.2.
A hoytboom is a boom mounted on the foredeck, the clew point of the jib is fixed to the end of the boom. When sailing downwind, it is better because you can get more wind in your sails. For a hoyt boom you need clearance on the foredeck for the boom to swing see fig. 3.3.

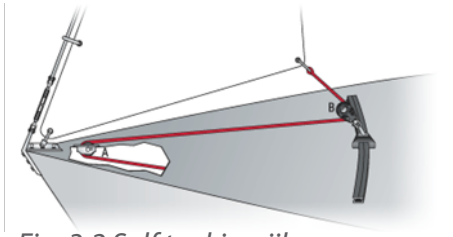


Fig. 3.2 Self tacking jib

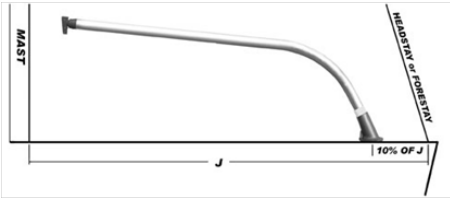


Fig. 3.3 Hoytboom

Furling sails: A furling mainsail is easier to stow away, because you don't need a hood over the sail. It rolls into the mast or boom. This appears very clean and neat, but it is not often seen nowadays. The mainsail can't be furling and square top at the same time because of the slats. The furling jib is very common used see fig. 3.4. For performance it is a negative development because the system is heavier and the shape of the sail cannot be optimal when it is furling.

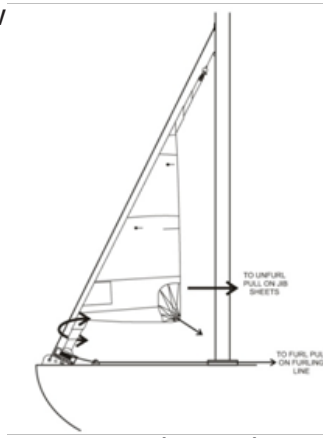


Fig. 3.4 Furling sail

Lazy jack: A lazy jack is an easy stowaway feature, it influences the appearance but it is mostly for convenience, very suitable for solo sailing, it doesn't require compromise on sailing performance see fig. 3.5.

Fig. 3.5Lazy jack

Retractable Keel: For sailing a deep keel is preferred, because your weight balance is better and your speed can be higher. When sailing on inland waters a deep keel can be very inconvenient because of the shallow waters. A retractable keel can be interesting, the benefits while sailing are not big because you will lose the balance when your keel is up. A big advantage can be the extended cruising area that you have because of the reduced draft. A disadvantage is the space that it occupies in the boat in order to create a retractable keel. The system for a bigger boat can be quite expensive.

Spray hood: A spray hood is most of the time some kind of screen or tent, it protects you from spray water see fig. 3.6. When sailing sporty, you can get spray water from bouncing on the waves, most people would like to sit dry and comfortably behind the spray hood. Disadvantage of the spray hood is that it takes away some sight and most of the time it influences the appearance.

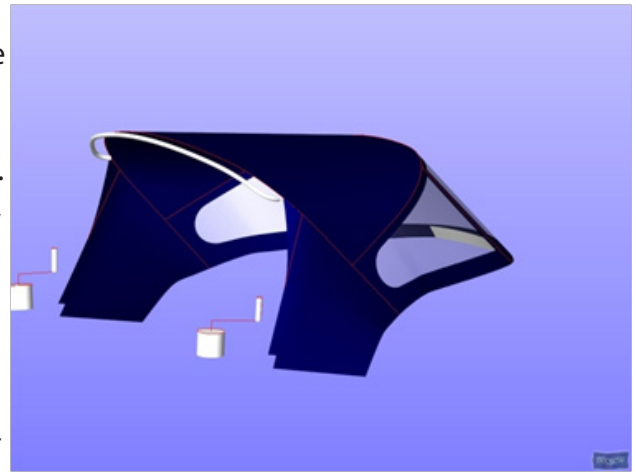


Fig. 3.6 Sprayhood

Deck covering: The covering of the deck should be antislip. Deck covering is important for appearance, some people might like a teak deck while others think that it is old fashioned.

Steering: For the steering features, a tiller or a steering wheel are the options and the decision whether or not an autopilot is included. This is often a personal choice. An autopilot is not a major expense but often only interesting if you are sailing long stretches on the same course. A tiller gives a more direct feeling when sailing.

Toilet:
By the prohibition of discharge of 2007 (Lozing), no black or grey water can be drained into open water. It must be collected in a waste-water tank. Because not every yacht of this size has a waste-water tank, there is an option for a chemical toilet. This includes a chemical liquid that breaks down feces and masks the odor. a chemical toilet needs to be emptied. On larger ships, toilets with waste-water tank are often found. These toilets sometimes have an electric pump, and sometimes hand pump. Another consideration with respect to the toilet is whether it is in a private space or not. This requires space, in current models you can see, that a porta potti is placed under a bed, or in another cabinet. Then you have no privacy when toileting.

Cooker: In the galley you can choose between different cookers, electric cookers especially if you want to cook ashore or other fuels if you want to cook on the go. If you want to cook on the go a gimbal suspension is desired.

Water tap: The tap can be electrical or hand pumped, even a water pressure system can be installed. Another question is whether there is a boiler in the boat, for showering it would be necessary, but also in the kitchen it can be easy. Next it is important how big the freshwater tank is. How long do you want to keep up without refilling and where do you use the water for. How much space is left and the weight is also interesting.

Refridgerator: For cooling the possibilities are real cooling or just insulation. Cooling absorbs a lot of electricity, while insulation can only last for a short period. Another question is size. Is it just for drinks or do you also keep food in the cooler.

Lighting: LED lighting is by far the most economical lighting option at this moment, they have a great lifespan(milieucentraal). The question whether you go for mood lighting or for fixed points of light is design dependent.

Bed: In the bedding a choice of materials should be made. More expensive pocket sprung mattress or standard foam mattress. Furthermore, do you want a fixed bed, or a convertible bed. This saves space but is an extra operation when going to bed. The next question is the amount of beds, and whether they are in huts or in an open space.

Sitting space: For the seating inside or outside a choice should be made for chairs or benches. Seats must also provide some comfort, sitting upright and have a comfortable backrest.

Map reading table: A map reading table is actually an outdated idea because most sailors nowadays navigate with a navigation system on a screen. Paper maps remain on board but a special place to read them is no longer necessary. A map reading table is almost never placed in a small boat, but in slightly bigger boats they still are a standard.

Storage space: Storage space is of course very much dependent on the purpose of the boat. Storage space may be divided by volume, the more the better, as long as you do not give in too much on living space and a spacious feeling. This consideration is very important because this concept design is focused on the perception of space, so storage space is a very interesting topic.

Table: Will there be a table in the design and is it outside or inside or both? Will it be completely foldable or in parts, or is it a permanent

table? The table takes away space and above all the sense of space, but it can be very practical when there is no map reading table available or to eat your dinner.

Heating: Hot air heating on diesel fuel is the most logical choice because heaters on fuel such as alcohol or petroleum are more dangerous and not very modern. A built in central heating is too much of a hassle and takes up to much space in a smaller boat. For electricity heaters a lot of power is needed, this is not an option on batteries.

Materials: Hull material and paneling material for the hull, there are a number of choices:

- aluminum
- polyester
- wood
- steel
- composite

Paneling: usually wood or composites are used for paneling.

Deck fittings: the deck fittings are the parts on the deck to guide and control the lines. The choice is whether it is automated and how far the lines are hidden below deck. The lines can be guided below or over deck and the lines can be operated by hand or by electrical winches and drum systems. These choices are connected with the sportiness, design and cost.

Electronics: A smart system could be built with sensors measuring how full the tanks are what the temperature and status of the Batteries are. You could connect to this system through your phone via wifi or there may be a central control point on a screen where all these statuses can be monitored. On this screen you can also control the sound system and do the navigation. You may add or remove features to the system. (Status monitoring display, tanks, batteries, navigation, wifi connection, lighting control)

Batteries: In an inboard engine a starter battery is always needed. In addition, there is often a 2nd battery on board for other usage. Often this is a lead-acid battery: a gel battery or AGM battery, the AGM battery is much more expensive. A gel battery has the advantage that it can be further discharged than other Batteries. Gel and AGM Batteries can be held upside down because the acid is kept in its place. So they are suitable for going awry. A gel battery is better in case of high discharge but has difficulty delivering high power. The AGM can do both but is also quite a bit more expensive. AGM Batteries have a lower self-discharge and distribute the energy flow better than a gel battery. There are also the new Li-ion batteries, these can last a long time and have very little weight with respect to their capacity. However, the battery may not be completely drained and have risk of ignintion if used incorrectly. This kind of Batteries is often developed specifically for a particular device. They require a control system to ensure that they are not drained completely and Li-ion are mostly even more expensive.

4 Target groups and modules

The following table shows the interest of the user in various modules. The rental target group is split into the letter and tenant because they have other wishes.(in appendix C requirements the first list of requirements can be found)
The plusses and minuses work the same as the table in chapter 2 Target groups:
--: no benefits
-
0
+
++: many benefits

	letter	tenant	wealthy thirties	50+
Sailing properties trim	-	+	++	++
Carbon mast	--	--	++	-
Laminate sails	--	--	++	0
Trim possibilities	--	+	++	+
Solo sailing	-	+	++	++
Self tacking jib	-	+	-	++
Hoyt boom	-	-	+	++
Furling mainsail	-	-	+	+
lazy jack	++	++	0	++
Electric control	--	-	0	+
Deep keel	--	-	++	+
Retractable keel	-	+	+	+
Auto pilot	--	-	++	+

	letter	tenant	wealthy thirties	50+
Design	+	0	++	+
Functional	++	+	0	+
Exterior design	+	0	++	+
Interior design	--	+	++	+
Conservative design	-	0	--	++
Wooden materials	--	+	+	++
Deck covering	--	0	++	-
Spray hood	0	0	-	++
Ambience lighting	+	+	++	+
Spacious cockpit	++	+	++	0
Spacious cabin	+	+	+	++
Inboard engine	-	-	++	++
Low price	++	++	--	+
Building costs	++	++	--	+
Maintenance costs	++	--	-	++
Durability	++	-	++	++

	letter	tenant	wealthy thirties	50+
Comfort	-	+	++	++
Ergonomic deck	--	-	0	++
Ergonomic cabin	--	+	++	++

	letter	tenant	wealthy thirties	50+
Length benches 1,80	++	++	++	0
Standing height	-	0	+	++
Heating	-	-	+	+
Hot water	-	-	-	-
Stereo	-	0	++	0
Cooling	+	+	++	+
Gimbal cooking	--	-	-	++
Non gimbal cooking	+	+	++	-
220 volt	-	-	++	-
Wifi	-	-	++	--
Private toilet	+	+	+	+
Storage	+	++	+	++
2 Sleeping places	+	+	++	++
4 Sleeping places	++	++	-	-

	letter	tenant	wealthy thirties	50+
Environment	0	-	+	-
Electric propul-sion	+	-	++	-
Construction	0	-	+	-
Trailerable	--	--	+	++

Target Group motivation

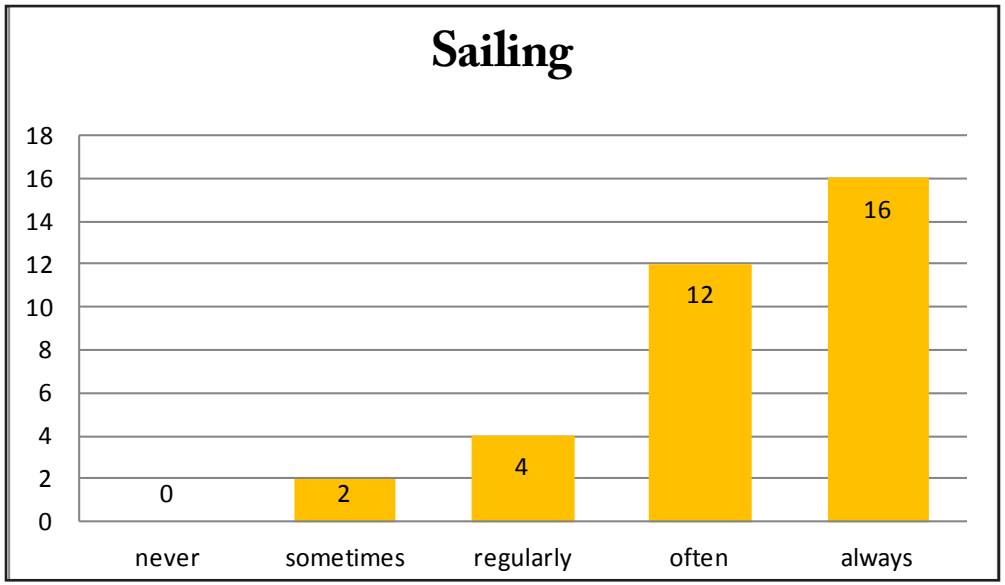
In consultation with the company, the rental target group is being disengaged, because the demands and wishes differ to much from the other two, the rental is very divers and therefore a hard target group to focus on. The remaining two target groups: wealthy thirties and 50+ are willing to spend money. In the end of the process it will be considered whether the target group rental can again be included with the same design, but with stripped features for example. For the design the focus will lie on the 50 + and wealthy thirties. After the scenarios the people with children were already disengaged because of the competition from secondhand boats. They can buy a slightly bigger secondhand boat for less money. For a new design it is not interesting to focus on this target group.

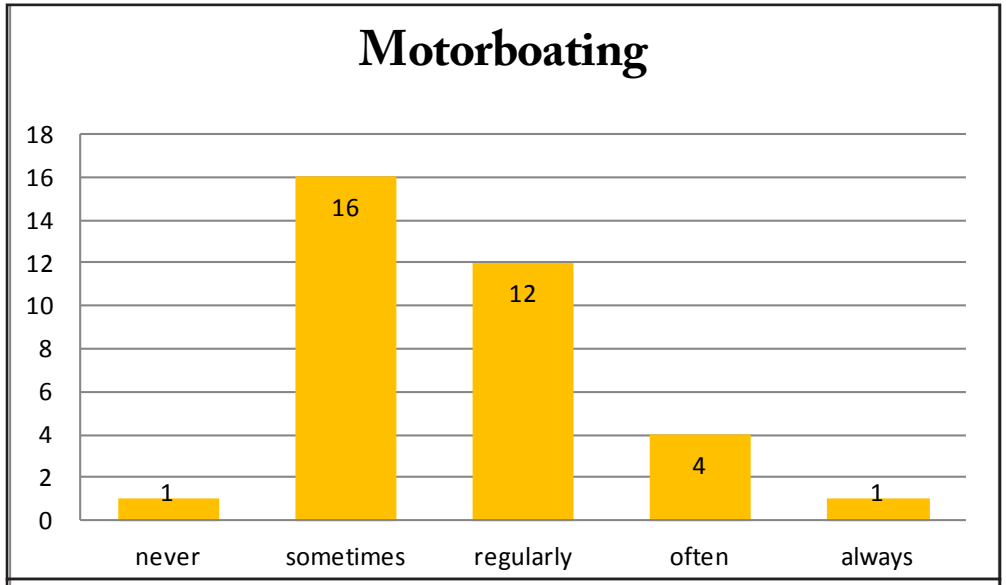
Interview with Geert Wijma

An interview with Geert Wijma, director of Jachtwerf Heeg, was arranged to double check the target groups (a summary of the interview can be found in appendix D Interview). Geert Wijma is a ship builder and seller and produces one of the newer yacht in the competitive market, the Pointer 25. He explains about his design process and chosen target groups and reviews the choices that were made so far in this design process. He says to not totally disengage the rental market because of the size of it. And he has never chosen the wealthy thirties because of the small size of this group. He tells more about the target group 50+ and gives a short introduction to the production process of a sailing yacht.

Questionnaire

A questionnaire has been conducted to confirm the provided table. In the questionnaire people were asked to order the aspects on which they would choose a boat and they were asked how often they perform certain activities on board. Of the 57 responses 34 are in the right age group: 23 in 50+ and 11 in 30-40. All of the participants are sailboat owners or regular sailors.
The average length of the sailboats these participants own is 26,6 ft with a deviation of 4,4 ft. This is a length of 8,0 m with a deviation of 1,3 m.
In the following graphs can be seen how often certain activities were performed on board. on the y-axis the number of people can be found




Motorboating
18
16
14
12
10
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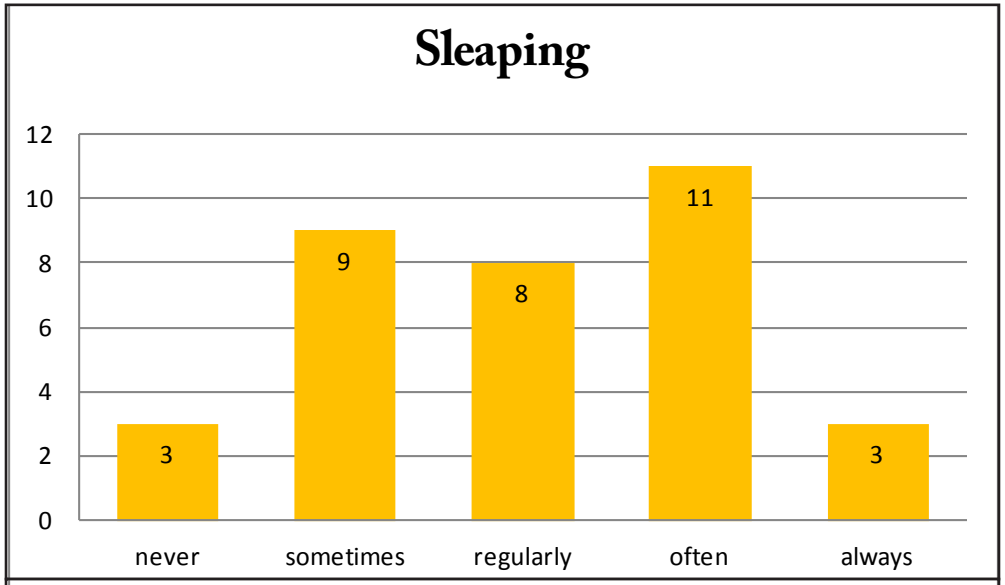
6
4
2
0
1
16
12
4
1
never
sometimes
regularly
often
always


Sleaping
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regularly
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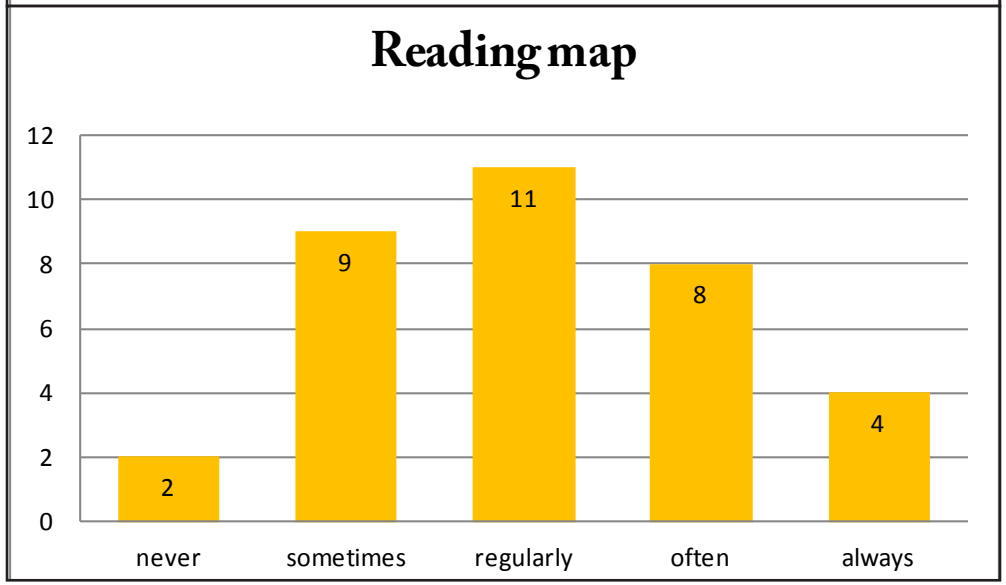
Reading map
12
10
8
6
4
2
0
2
9
11
8
4
never
sometimes
regularly
often
always


Cooking
12
10
8
6
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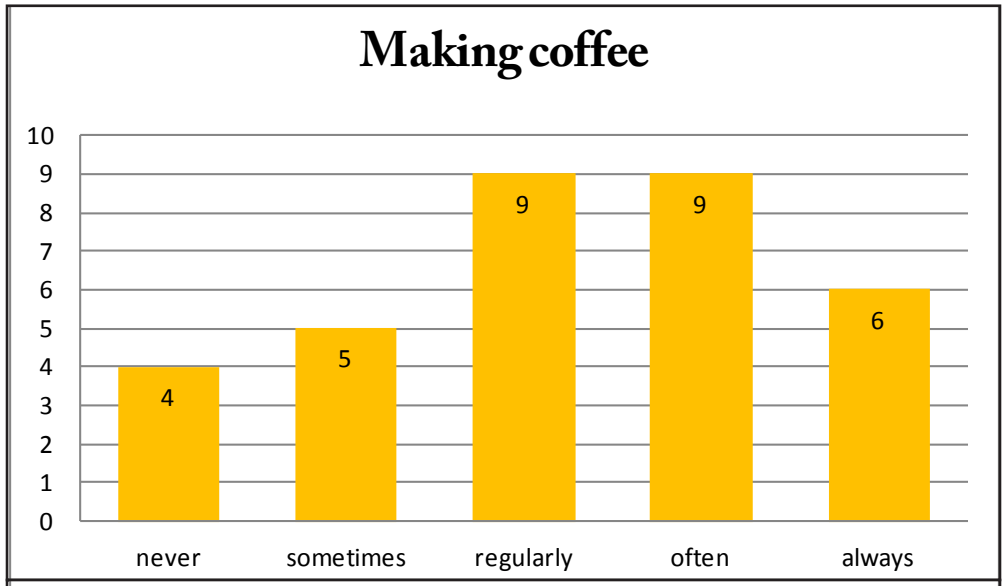
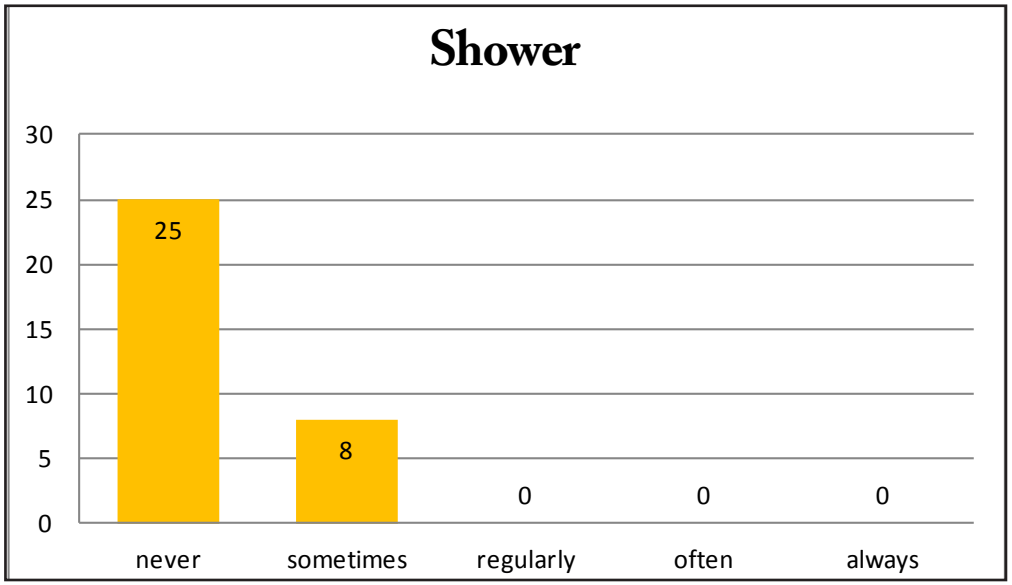
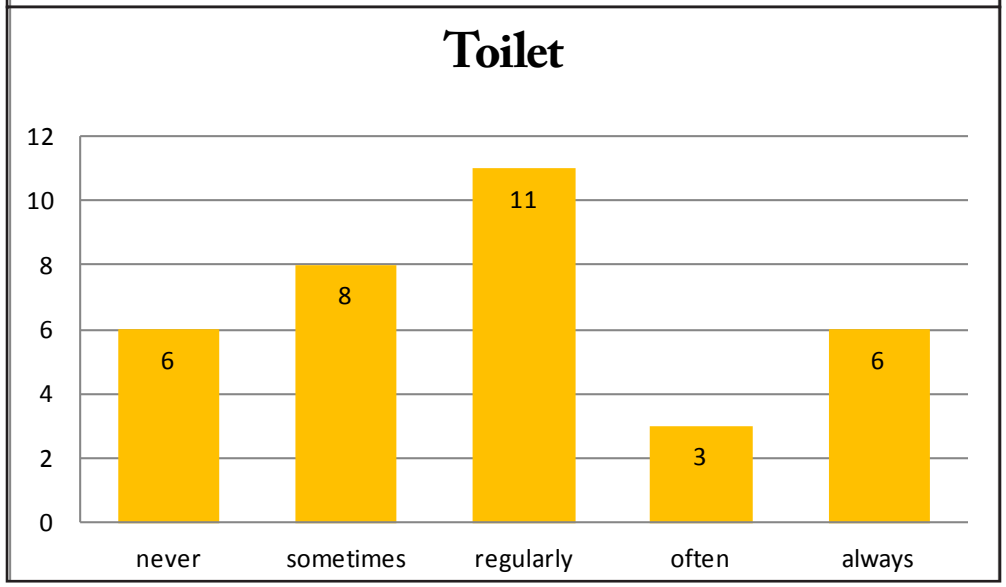
10
5
11
2
never
sometimes
regularly
often
always







When choosing a new boat the decisive choosing aspects were ordered by the participants. When placed on first place the aspect got 7 points, when placed on last place it got 1 point. The total amount of points for every aspect can be seen in the table below

Targetgroup choosing aspects	points
Sailing properties	183
Size	183
Comfort	156
Costs	145
Design	116
Facilities	115
Environment	51

From this questionnaire it appears that people value sailing properties and comfort more than design or facilities, it also appears that the environmental issue isn't found very interesting. In the facilities, the cooking sleeping and toilet are important. A shower is not necessary. People don't expect it to be present in a boat of this size. For the individual answers see the appendix E questionnaire.

5 Competition analysis

In the competition analysis several boats which are sold in the market are observed and analyzed. In the table you can find the length over all, the depth, the material of the hull, the number of beds and the CE design category. The CE design category is based on cruising areas for a certain certification you have to meet certain ISO standards. The A stands for ocean, B for sea, C for coastal and D for inland waters. Also the positives and negatives from each design are listed. Here only the more interesting and newer designs are chosen among the wide variety on the market (for a full size version see appendix F competition analysis).

	Elan210	Etap22	Fox 22	Waarschip 700 LD	Sportina 680	Pointer 25	Beneteau 25	Winner 8
LOA(m)	6,34	6,60	6,60	6,70	6,80	7,60	7,90	8,00
Draft(m)	0,50 – 1,55	1,25	1,25	0,70 – 1,20	0,30 – 1,40	1,10	0,85 – 1,85	1,50
Sail area(m2)	28,3	29,4	23,5	32,4	23	25	33,3	42
CE	C	(out of production)	C	B/C	B	B	B	B
beds	4	4	4	4	4	4	4	5
picture								
Positive:	sportive sailing, good space solutions	buoyancy, safety, stability	interior space, forecastle deck, robust, sailing performance	modern new design, sailing characteristics	low cabin, asymmetrical interior design	closed stern, thought of toilet private, thought of production, inboard motor	high backrest, built-in motor, separate toilet	all facilities available, good seating, extra double bed
Negative:	outboard motor, messy look inside	old fashioned, little facilities	appearance, comfort	designed for sports, no facilities on board, uncomfortable	small cabin entrance, outboard motor	plastic design	small cockpit, classical interior design, many partitions inside	Interior design, small cockpit, open stern spoiled by railing

6 Design motivation

The design will focus on the interior and deck; the 4 key goals of this new design are: improvement of space perception, ease of operation, comfort and appearance.

Cooking appeared to be a key issue from the questionnaire, therefore attention will be spent to that. Also the toilet was something often used by the target group. In the design these points will be kept in mind. One of the ideas in the redesign is realizing the possibility to cook inside and outside. With hot summer weather people don't want to go inside and stand in the hot cramped cabin for cooking. Older people and women would like to have a toilet aboard. The galley and toilet are close to the entrance so they are easy to access during sailing. It is chosen to not cram the interior with beds and as many facilities as possible but to keep it simple and go for quality over quantity. Therefore only 2 beds are placed in the design.
Sailing remains the most important point so the redesign should not interfere with the sailing capacities. Most important for wealthy thirties is the appearance, for the 50+ it has to be practical. Both are kept in mind. The design is suitable for touring on inland and coastal waters. In the project the focus will lie on the design of the interior and the deck, therefore less attention is paid to the rigging and construction. Although the rigging plan is actually outside the scope of this project, it has been thought of. The rigging plan won't be redesigned from a standard rigging plan.

	wealthy 30`s	50+
Principle dimensions		
Length overall is 7 to 9 meter		
Beam is max 2.55 m (trailerable)		
Draft for inland waters is max 1.20 m		
Inboard motor ≈ 7,3 kW	electric	diesel
Sailplane ≈ 30 m2 (without genaker)		
Construction		
Polyester		
CE-norm C		
Rigging plan		
Mast	carbon	aluminum
hoytboom (furling) jib 100%		
Mainsail	square top	-
No backstay		
Genaker		
Lazy jack	-	lazy jack
Interior		
Spacious cabin		
Lounge, with seats or a bench with backrest		
Seats with shaped foam		
One double bed with thick mattresses		
Galley with at least 2 burners	electric	alcohol
Cooling facility		
Sink		

	wealthy 30`s	50+
Private toilet		
(Indirect) Led lightning		
There is storage space under the seating and the bed		
Near the bed is another storage space for clothes		
Installation		
Battery		
Fuel tank ≈60L		
Freshwater tank ≈60L		
Waste water tank ≈ 60L		
Heating with hot air heater(diesel)		
12 volt system for motor		
12 Volt system for the facilities		
Extra electricity	220 V	-
Deck		
Spacious cockpit		
Comfortable seating		
Tiller		
Motor control near the tiller		
2 winches for the sheets		
Winch for halyards and trim		
The mainsheet is mounted on the stern		
A big skylight		
A hatch on the foredeck for ventilation		
Stern	open	closed

From this list and the process before there were some conflicts between the two target groups. For the 50+ cooking electric is not a good option because of the impossibility of cooking on the go. Batteries cannot be large enough to power electric cooking, for calculations see appendix G electric cooking. For them alcohol would be the best because of the safety instead of gas cooking. For wealthy thirties alcohol is not an option because it is old fashioned and doesn't look good. They would be happiest with an electric cooker, because it looks very nice and they will probably just use it ashore.
The motor is another point of conflict. For 50+ it has to be an inboard diesel because it is reliable and safe. For the wealthy thirties it would rather be an electric motor for sound and for the degree of modernity.
220 volt is desired by the wealthy thirties but the 50+ have little use for 220 volt. The closed stern feels safer and secure for the 50+ but an open stern feels more sportive for the wealthy thirties.

All these conflicts might be made into modules, options of choice for the owner. Most of them are regular parts, except the open and closed stern, but this can easily be covered with an extra mould, says shipbuilder Geert Wijma(see interview Geert Wijma). An extra part is placed in the mold to create a closed stern. Also the color and materials can be options. From now on the design will be for the wealthy thirties and then converted to 50+ and if possible rental. First the shape and functionality will be designed, then the material and appearance will be adjusted because the shape is something that will be the same for all target groups. The color and styling can be differed as easily as other parts can.

7 Styling

Optical space

In the appendix H optical space, the effects of darkening and lightening certain surfaces is explained. The space on board needs to seem wide and deep so the floor will be dark, the ceiling light and the side walls will go from a dark tone to a lighter one in a bright color. When picking light colored paneling, we will go for darker fabric. When we go for darker paneling we will pick lighter fabric to create contrast. Some other interesting points to create optical space:

- With horizontal Lines the space looks wider, make sure they are uninterrupted.
- Patterns make things seem crowded and therefore smaller.
- Diagonal lines give a feeling of movement, and make a space seem bigger.
- Not too many eye catchers in one space, clean design.
- Lighting should be placed at eye level to make things seem bigger.
- When the plinth is the same color as the floor, the floor seems bigger and therefore the space too.

Styling objectives

More detailed style and mood boards for the target groups were made. The feeling the interior should give:

- Cozy
- Luxurious
- Warm

The feeling the exterior should give:

- Sportive
- Special/outstanding
- Comfortable

For every target group a product collage and mood collage were made. The product collages will be used to design the details and the mood collages for the styling and overall design.

The exterior of the design can have a slightly more cold appearance than the interior. The interior needs to feel warm and cozy therefore brownish colors will be used with multiple types of wood. On the exterior grayish colors will be used as well as brighter accent colours.

When looking at the concept cars most likely the design will be based on the KIA KV7 and the BMWI 3 for interior and the Toyota concept car for exterior.

50+

In the collages for the target group 50+ some similarities can be seen:

Solid blocklike forms are used
Square and edged forms
Warm colours
Fabric and wood

These points can be used in detailing and designing the 50+ design.

Fig. 7.1 Moodboards 50+

Wealthy Thirties

In the collages for the target group wealthy thirties some similarities can be seen as well:

Darkbrown and grey colours
Accents in bright colours
Geometric forms
Dark wood and leather
Sharp-edged and lightweight design

These points can be used in detailing and designing the design suited for wealthy thirties.

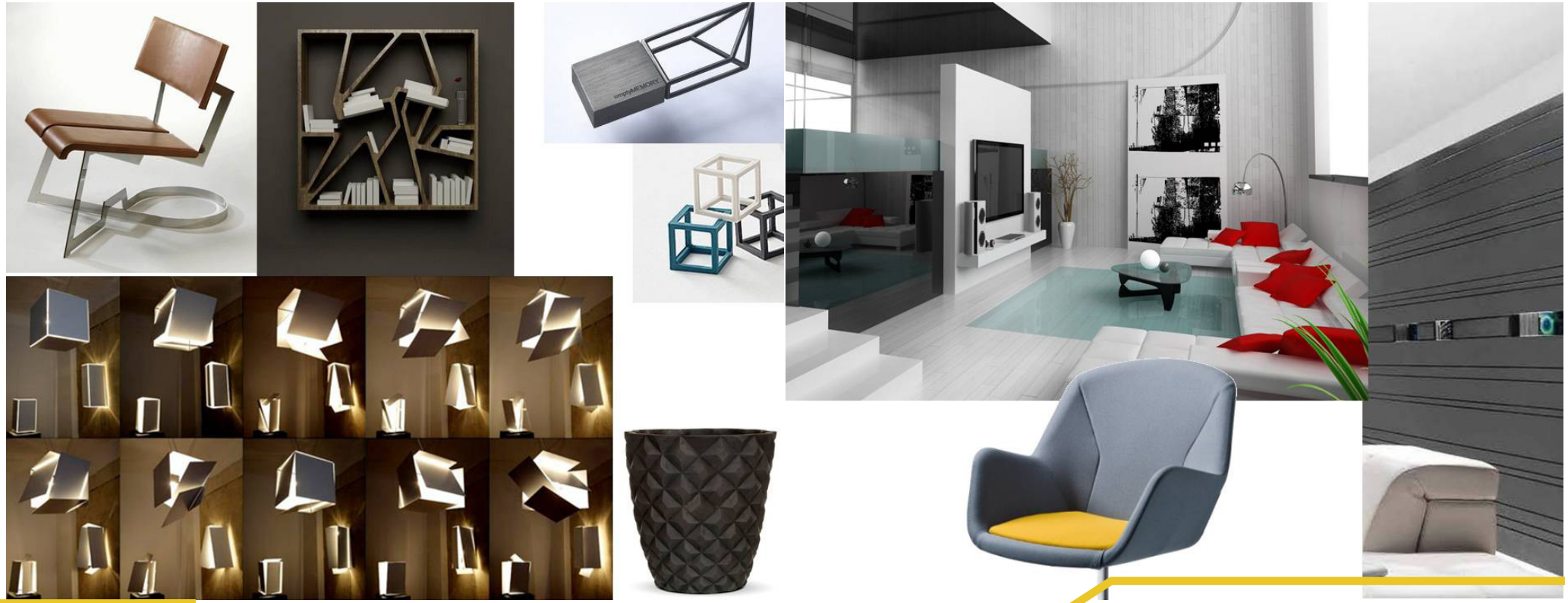


Fig. 7.2 Moodboards Wealthy Thirties

8 Layout

For the layout study scaled parts were cut out from foam and placed onto a boat shape with the approximate size of the boat. (the width is fixed but the length is still flexible in this model 8,00 m) different configurations were tried out. See fig. for the different layouts here the size of the cabin and the placement of bed, toilet and kitchen were tried out. The orange part is the cabin the blue parts are the cockpit benches.

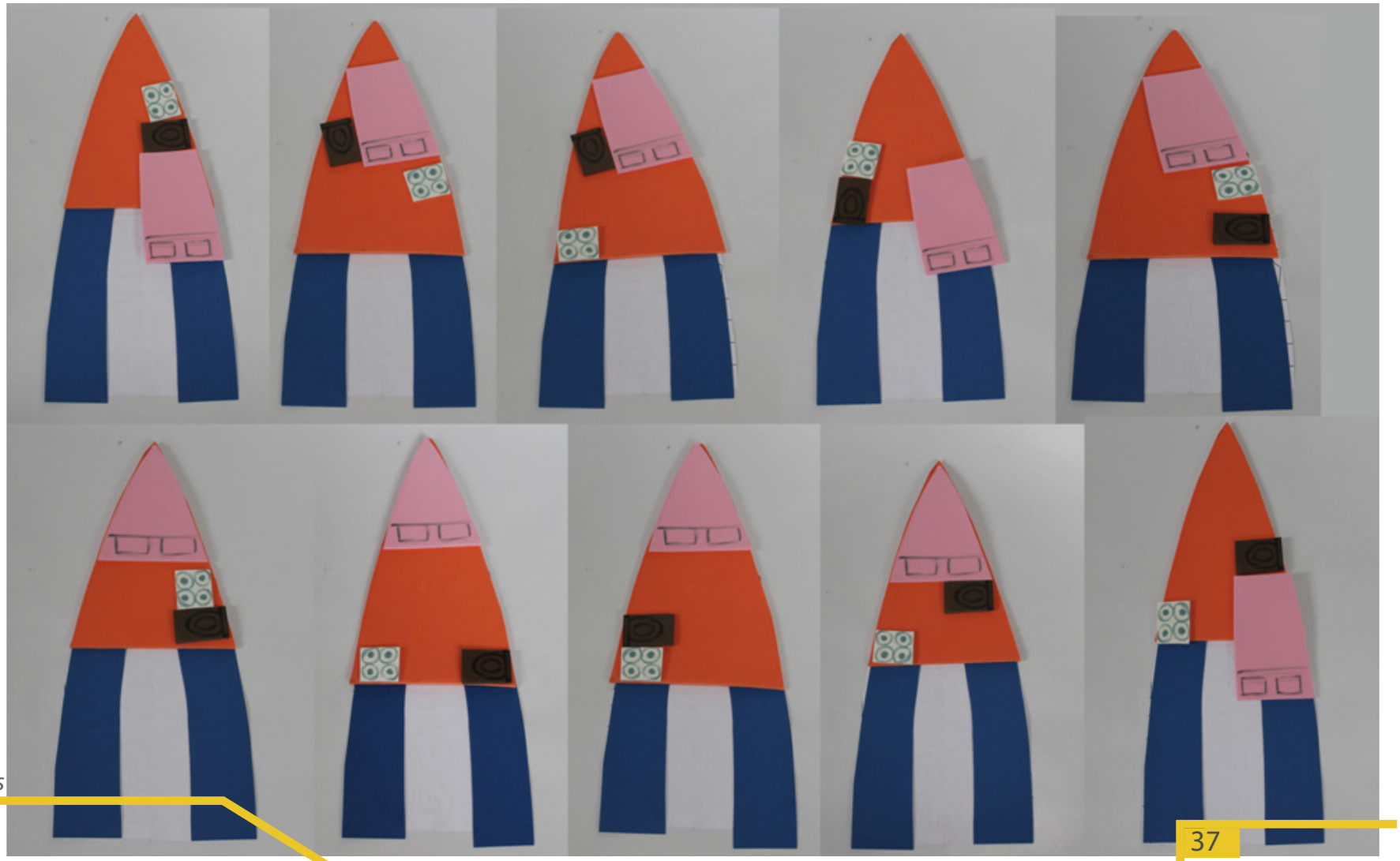


Fig. 8.1 Pictures layouts

Sketching

First some sketching and ideation was done in multiple directions the styles were a bit neglected but will be covered later on.
More Layout-sketches were made in this first serie layout sketches from top-view and cockpit were made.

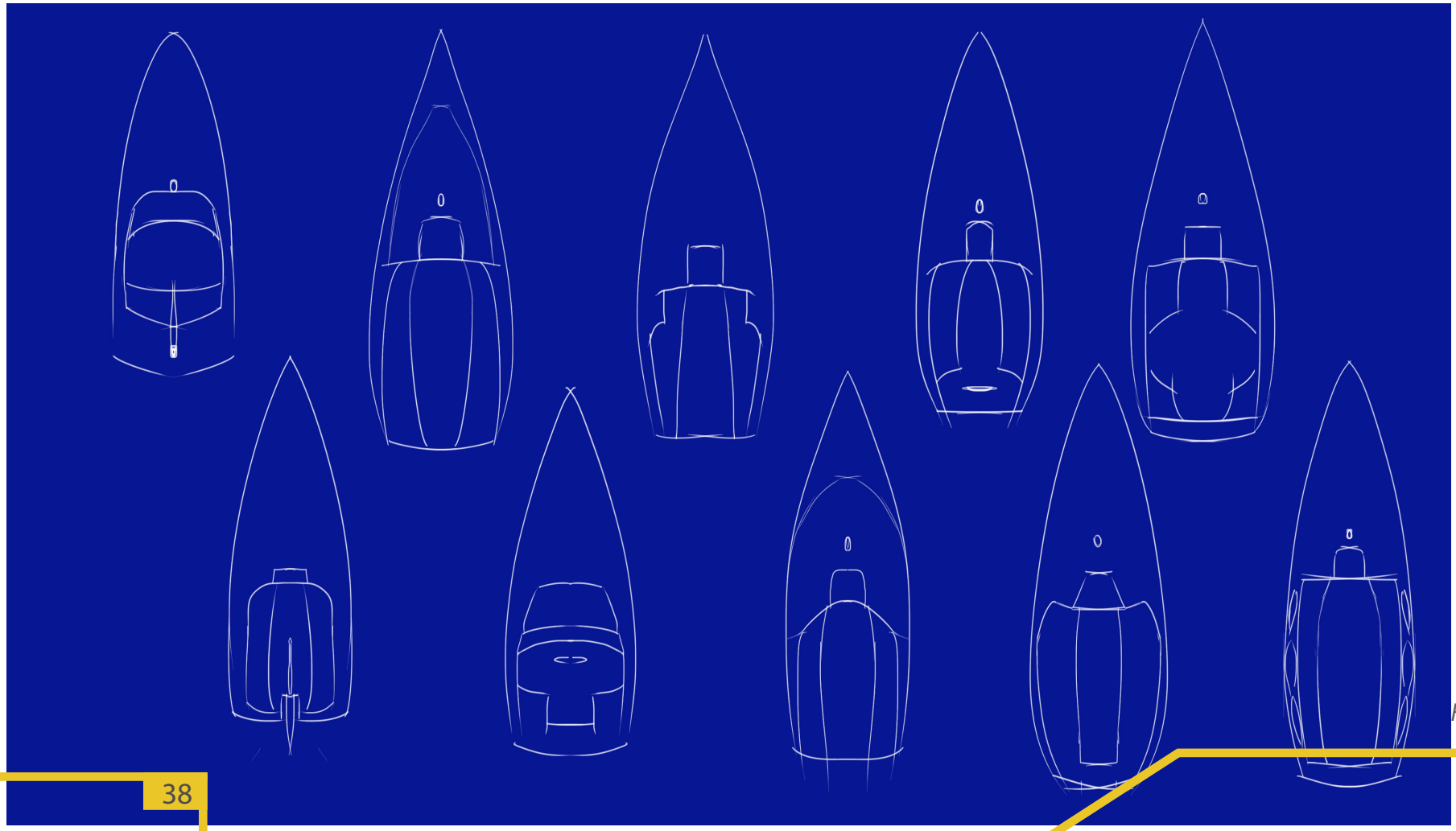


Fig. 8.2 layout sketches

in these sketches and on the following pages, the interior was sketched. the layout of several facilities in the cabin. Sketch number 3 is the base which is used to trace the proportions of a regular sailing yacht.

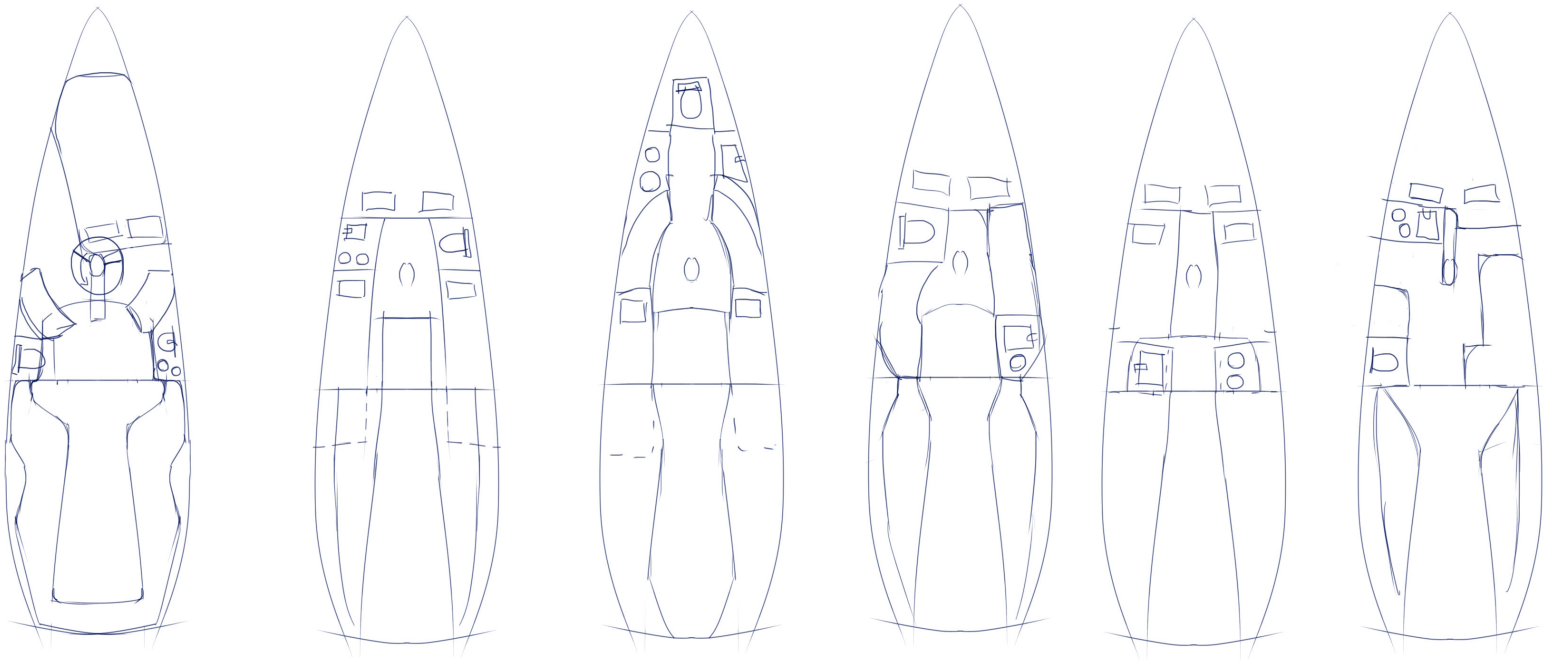


Fig. 8.3 layout sketches

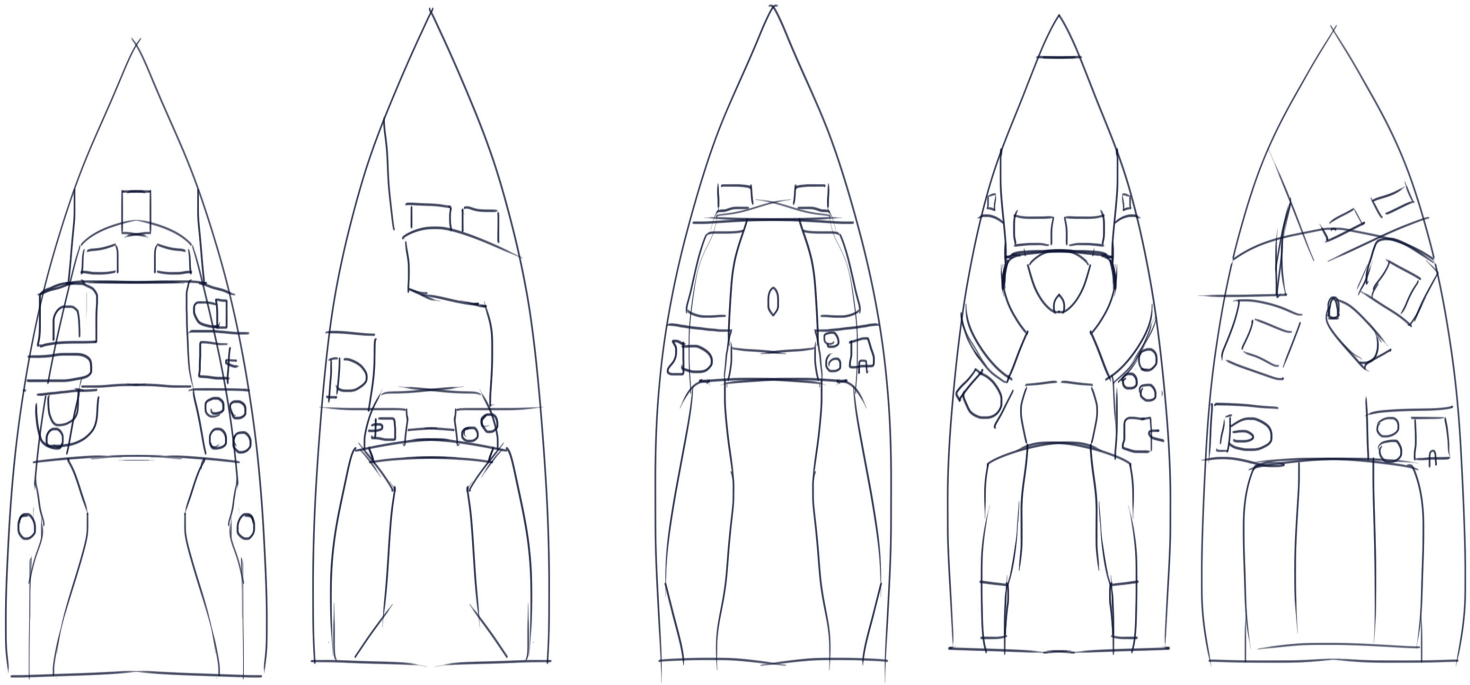


Fig. 8.4 layout sketches

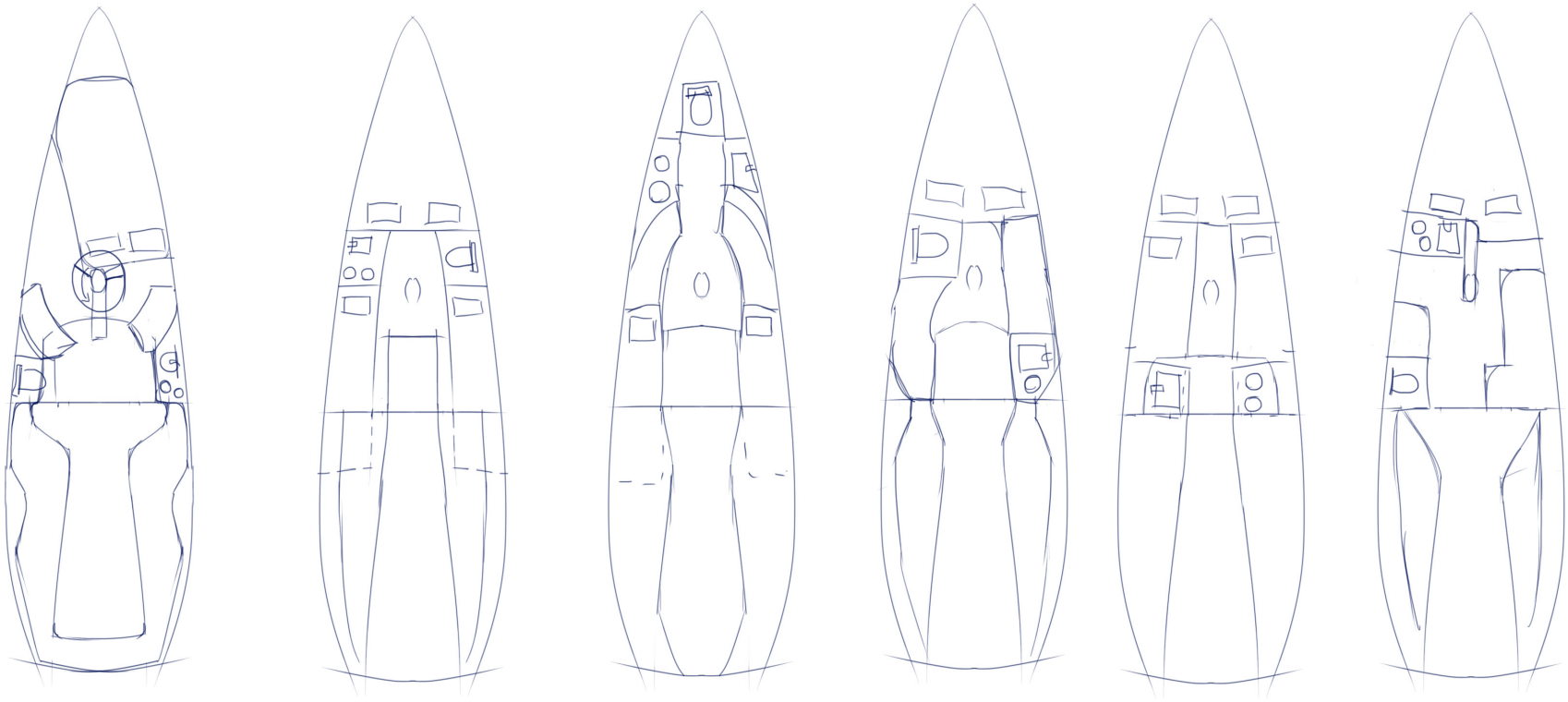
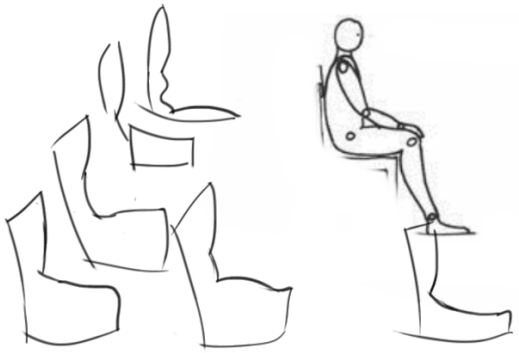


Fig. 8.5 layout sketches

In these sketches the ergonomy has been looked at. When sitting straight on the outside bench a normal sized person has to be able to see over the super structure. Some of these sketches were further elaborated on the next page.



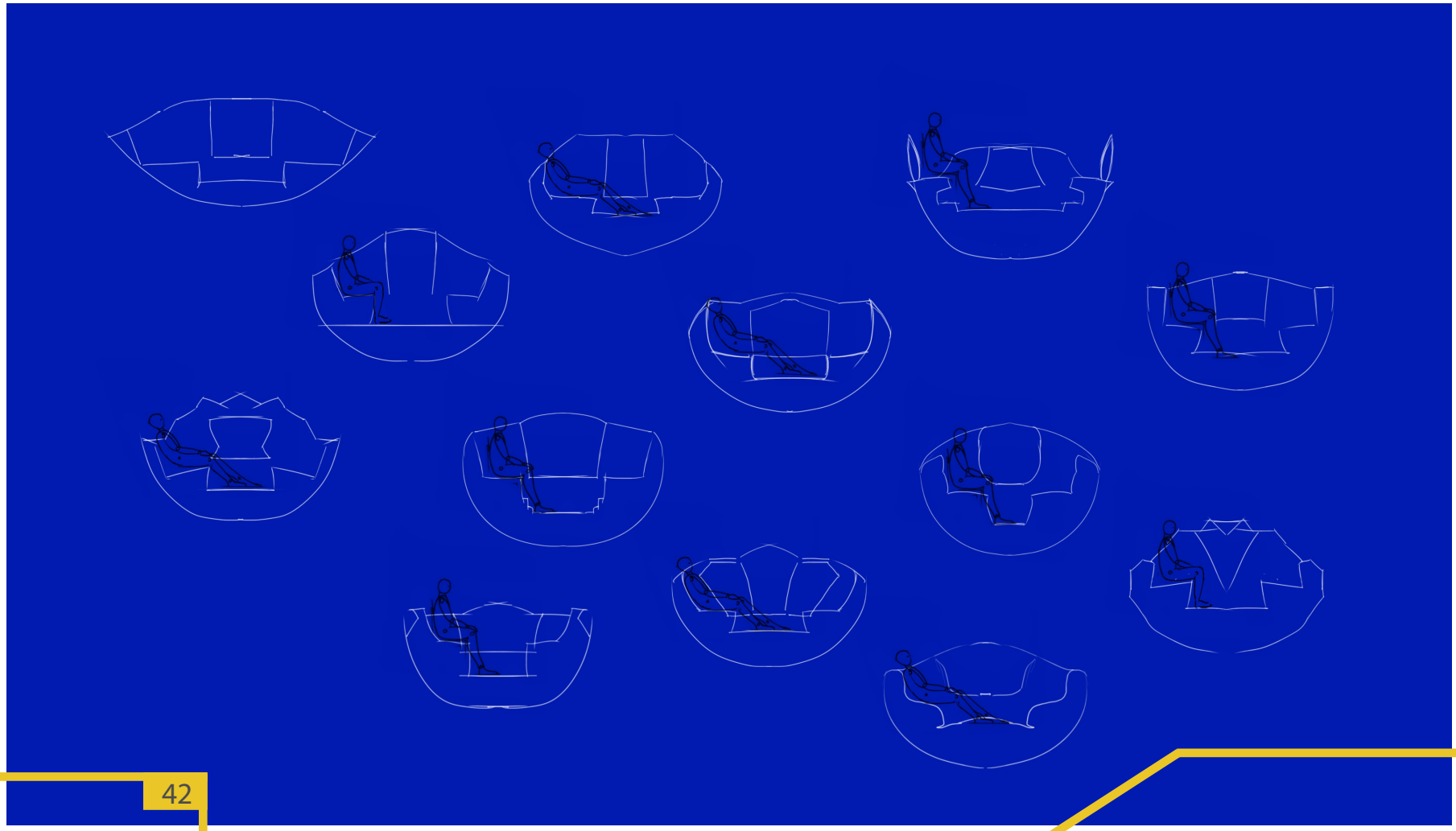


Fig. 8.6 section views

Here you see 4 elaborations of some ergonomic sketches, the dummy is placed for proportions.

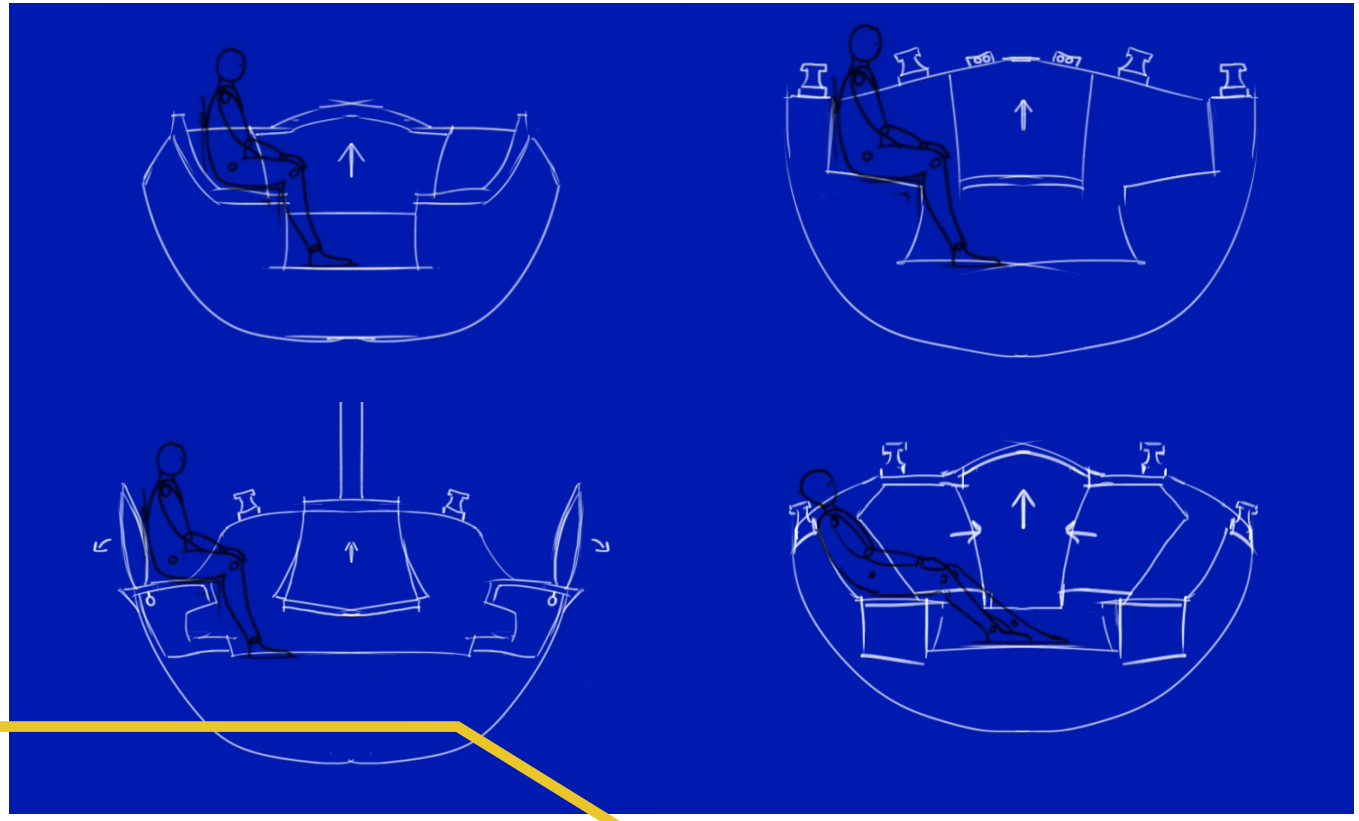


Fig. 8.7 Elaborations

9 Concepts

seating inside

3 concepts have been generated: the first is a round bench. This gives a cozy feeling. In this concept the round bench was placed around the mast support, it is placed fairly far to the front of the ship, the facilities are placed close to the door opening. See fig. 9.1. this concept isn`t good for the perception of space because of the blockage of sight.

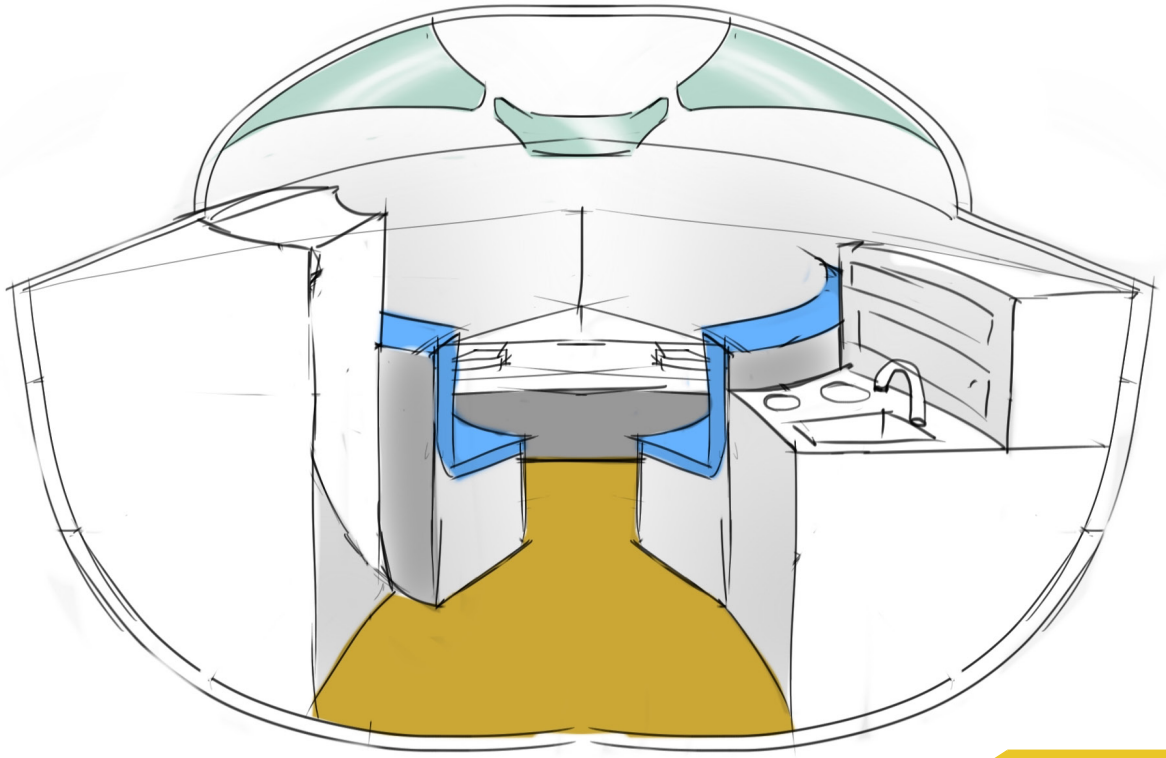


Fig. 9.1 Concept round bench

The next concept for seating inside is 2 rotatable and sliding chairs instead of a bench. It is more comfortable than a bench because of the preformed foam cushions. This concept is very good for the space perception the space looks bigger because the chairs are loose from the wall and dont block the sight.

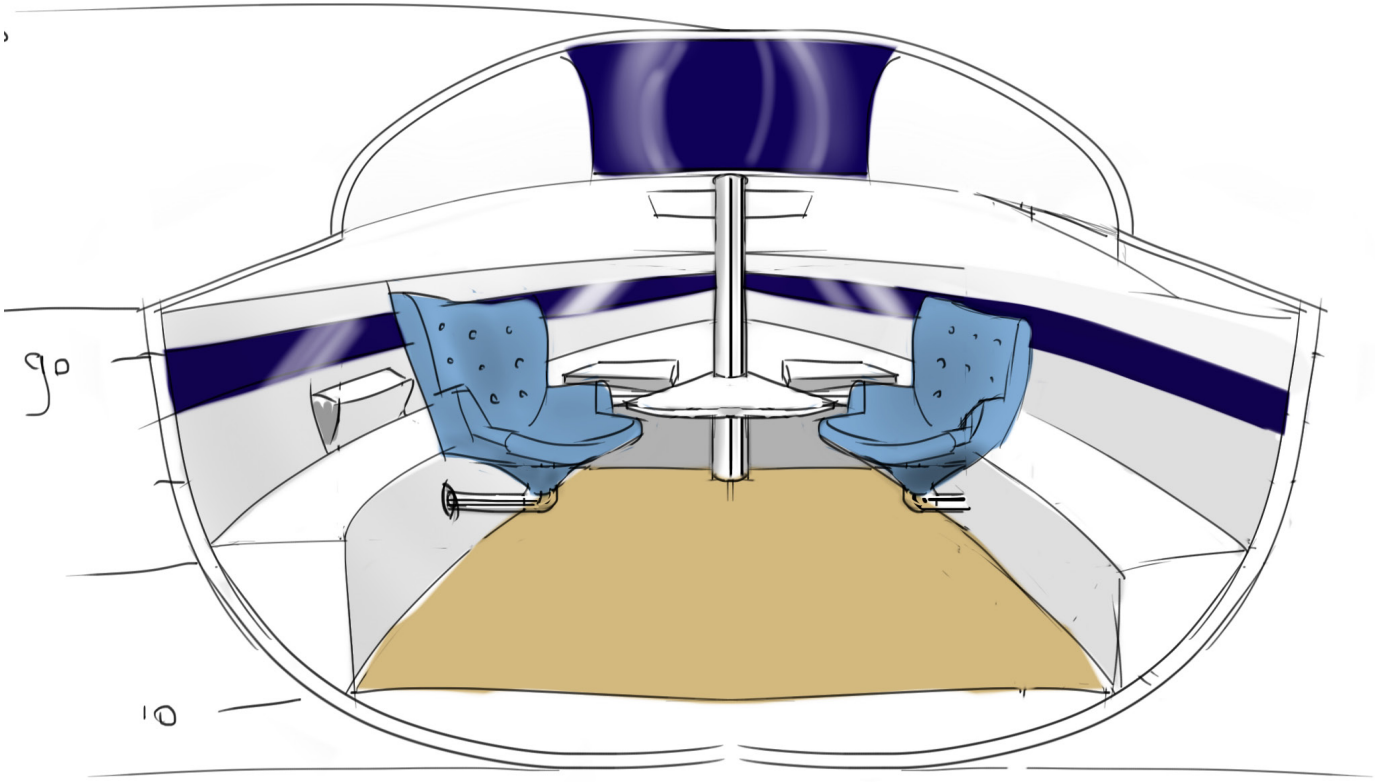


Fig. 9.2 Concept chairs

The last concept is an idea of enlarging the bed and make a fold away backrest to create a lounge bench. The backrest is part of the double bed when folded down the bed is very long. The bench is u-shaped so there are two footrests. This concept has a bad ease of operation. It takes operations to convert the bed to bench and backwards.

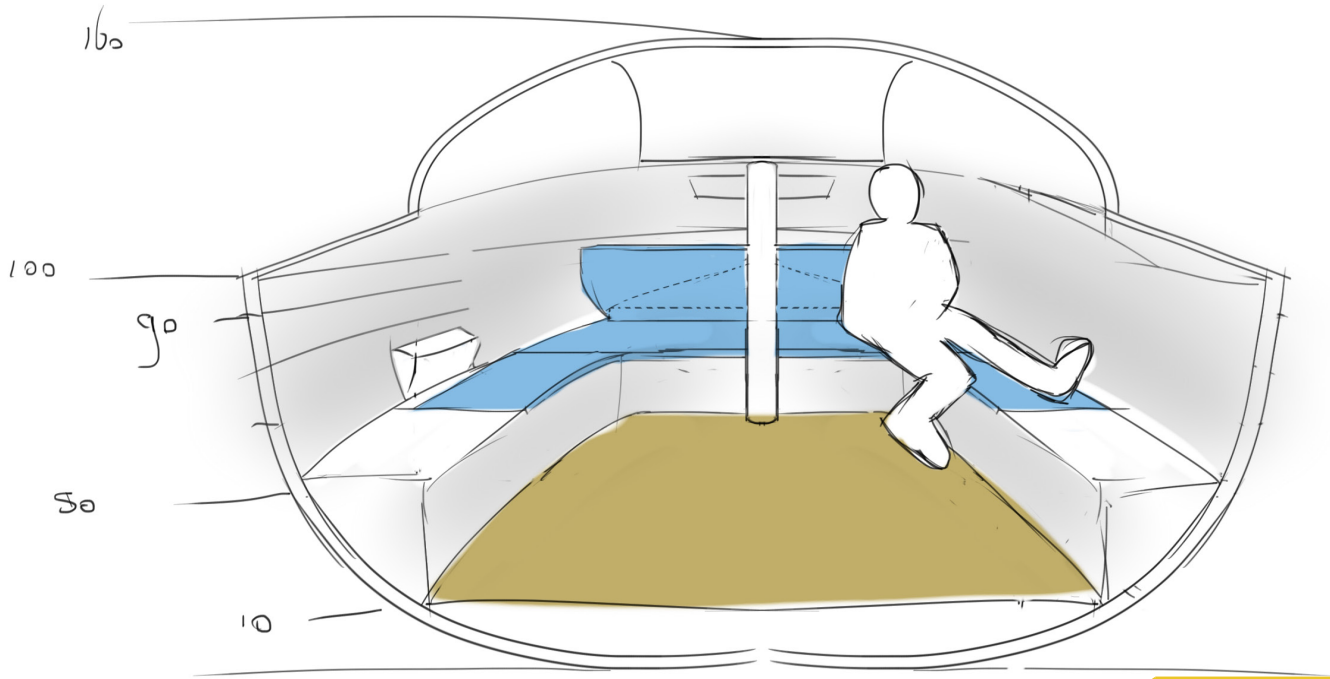


Fig. 9.3 Concept foldaway bench

Cooking

The first one is a galley close to the opening with a big opening so the space inside and outside are more one and you can reach the galley when inside or outside. This is good for the cooking in- and outside but doesnt do much for the space perception.

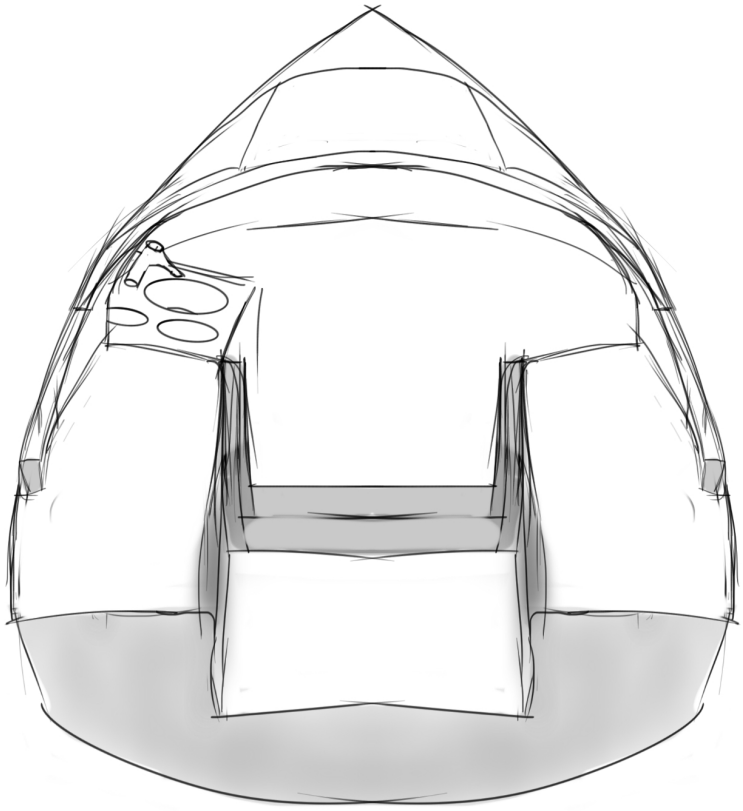
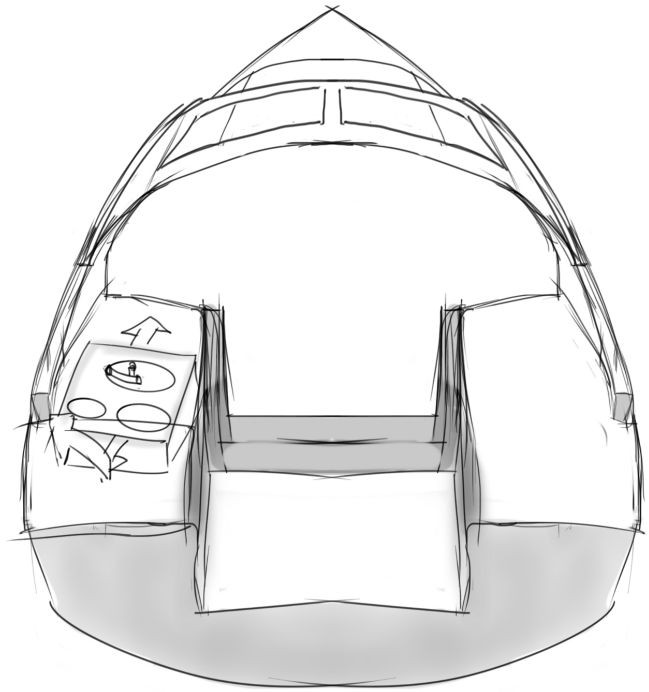


Fig. 9.4 Concept kitchen inside

The second is a sliding galley underneath the cockpit benches, where a hatch can be opened to cook outside or slide it outwards to cook inside. this concept is very suited for cooking inside and outside and is also good for the space perception because it can be slided out of sight. This idea is inspired by the folding kitchen of the Travelino Lightbau in chapter 1.



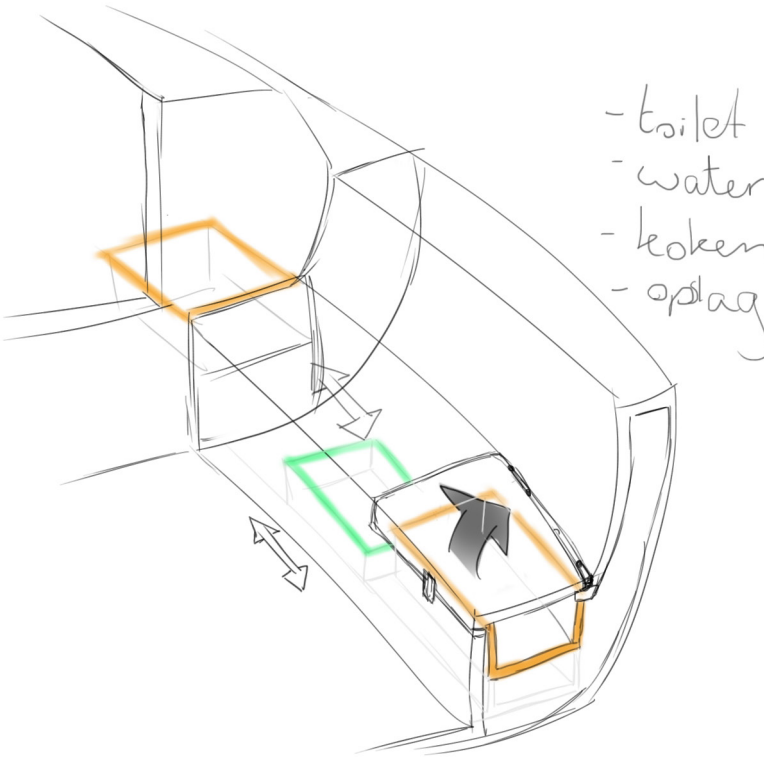


Fig. 9.5 Concept sliding kitchen

The third concept is a kitchen outside with a covering tent so the space can be made into space inside or outside. This concept is not so easy for cooking in and outside and is only good for the space perception inside. Outside the space is reduced by the galley.

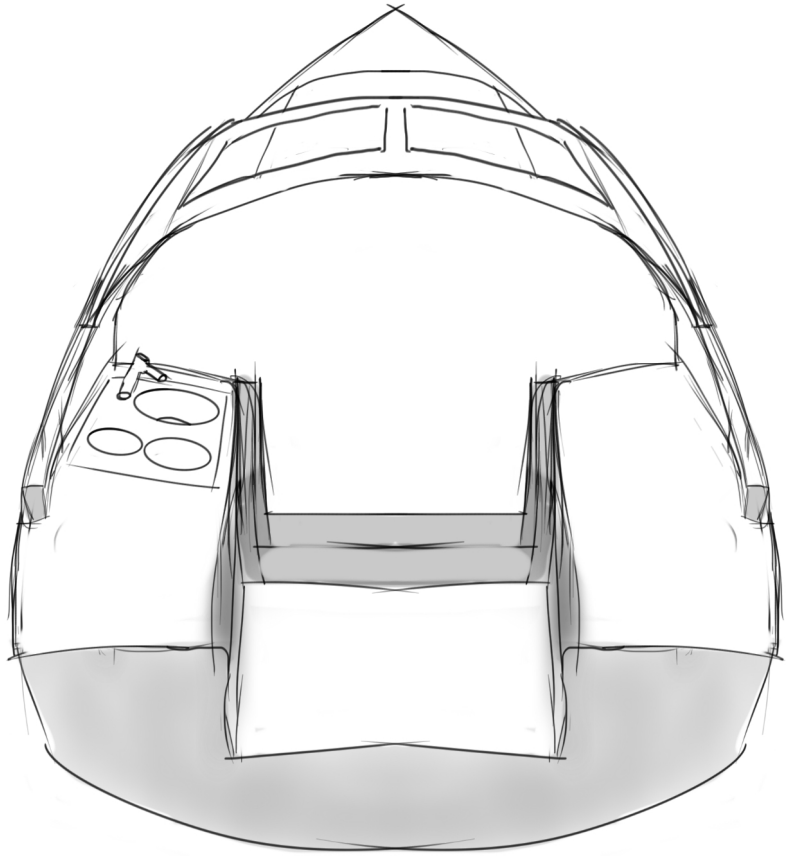


Fig. 9.6 Concept kitchen outside

Seating outside

for this part 2 concepts were generated, the first one is a fold up back-rest to create a sportive yet comfortable design. The back-rest is made of foam. It is flexible in use so the sailing remains sporty but it gives some comfort as well. This idea is inspired by the hatches on the Topos sail caddy by VW in chapter 1.

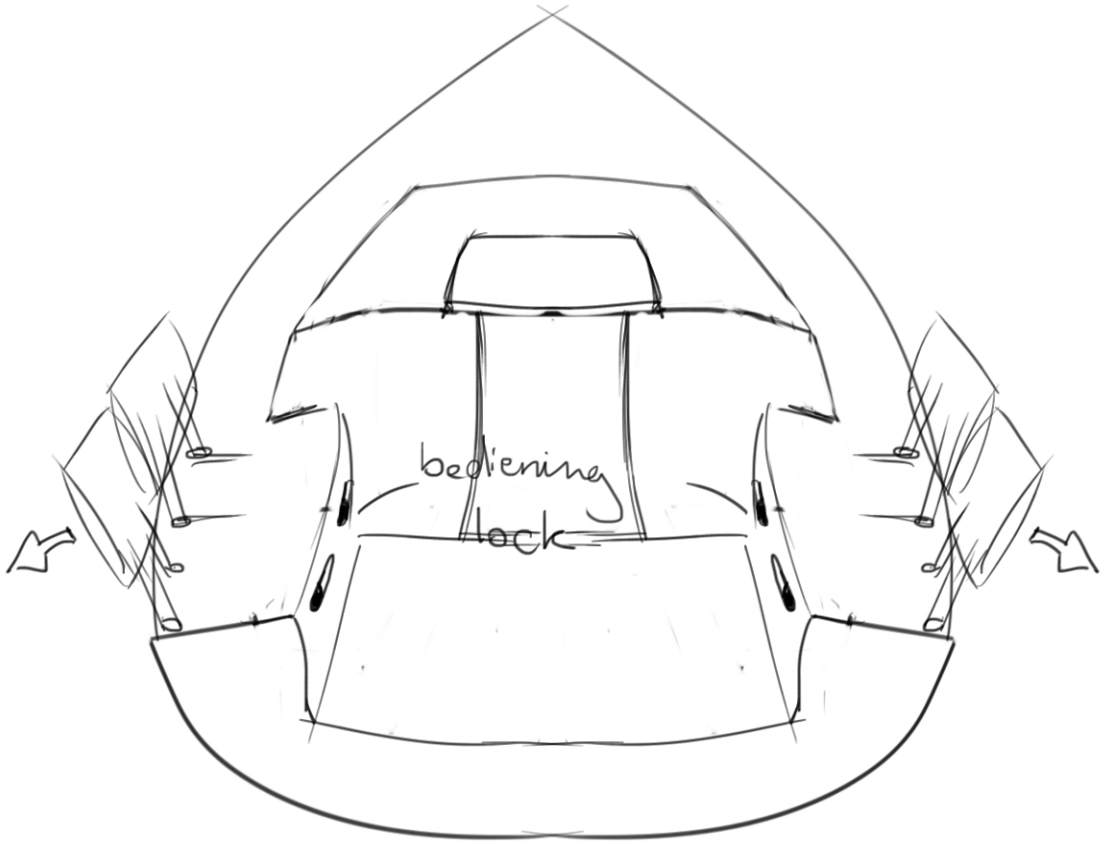


Fig. 9.7 Concept fold up backrest

The second one is a solid backrest but with an inlay of a cushion. The benches just naturally flow into a cushion, with a watertight coating. The seating is very comfortable but the sailing is less sportive.

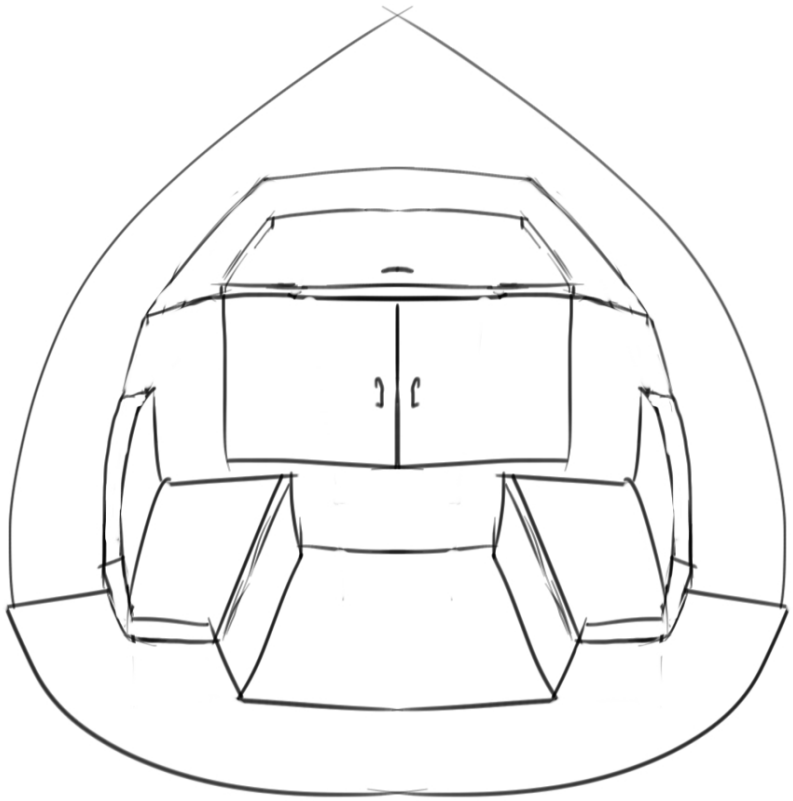


Fig. 9.8 Concept foam bench

Opening

Three concepts were generated for the opening. The first concept is an enlarged opening closed by a zip cloth. This might appeare a bit messy but the enlarged opening gives a lot better space perception and is very flexile in use. This kind of zip cloth is sometimes used in larger sloops. Therefore this kind of solution is suitable for the target group.

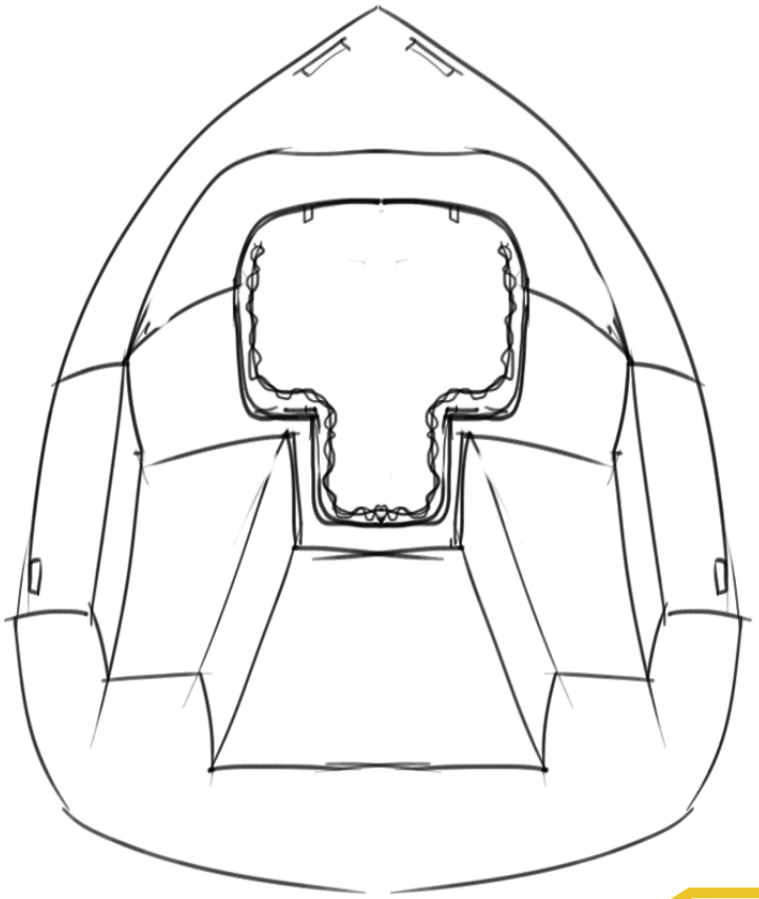


Fig. 9.9 Concept large opening

The second concept is a tent you can pull up from the superstructure to create more inside space this idea takes some extra operations but creates a lot more interior space.
This idea is inspired by the Dehler red-riding-hood in chapter 1.

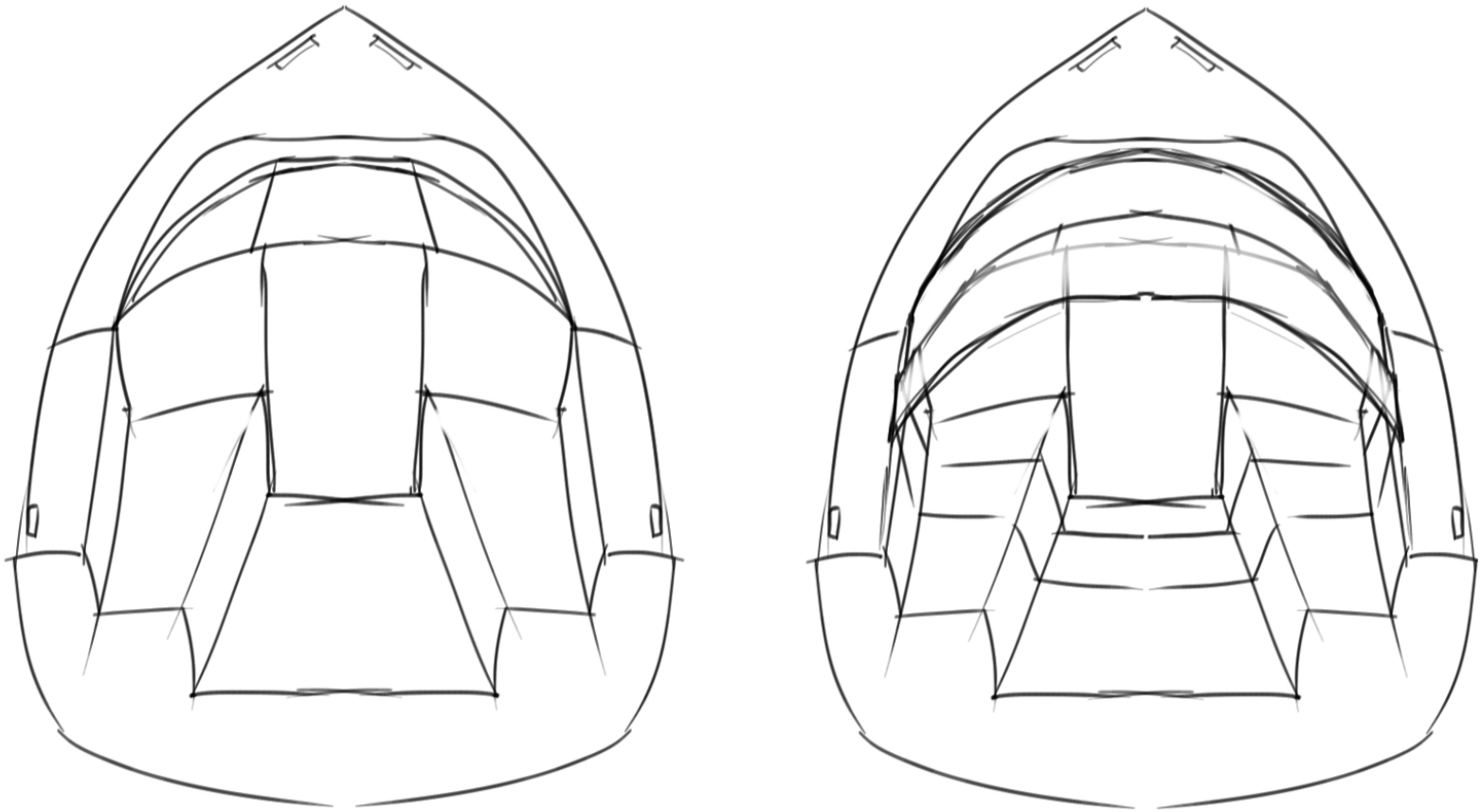


Fig. 9.10 Concept tent

The third concept is a lifting roof. This creates more headroom inside but the appearance isn't very attractive and the ease of operation is low as well. With adjustments in shaping it might have a better appearance, but the construction isn`t convenient because it is blocked by the sailing gear, such as mast and boom. The lifting part could only be fairly small.

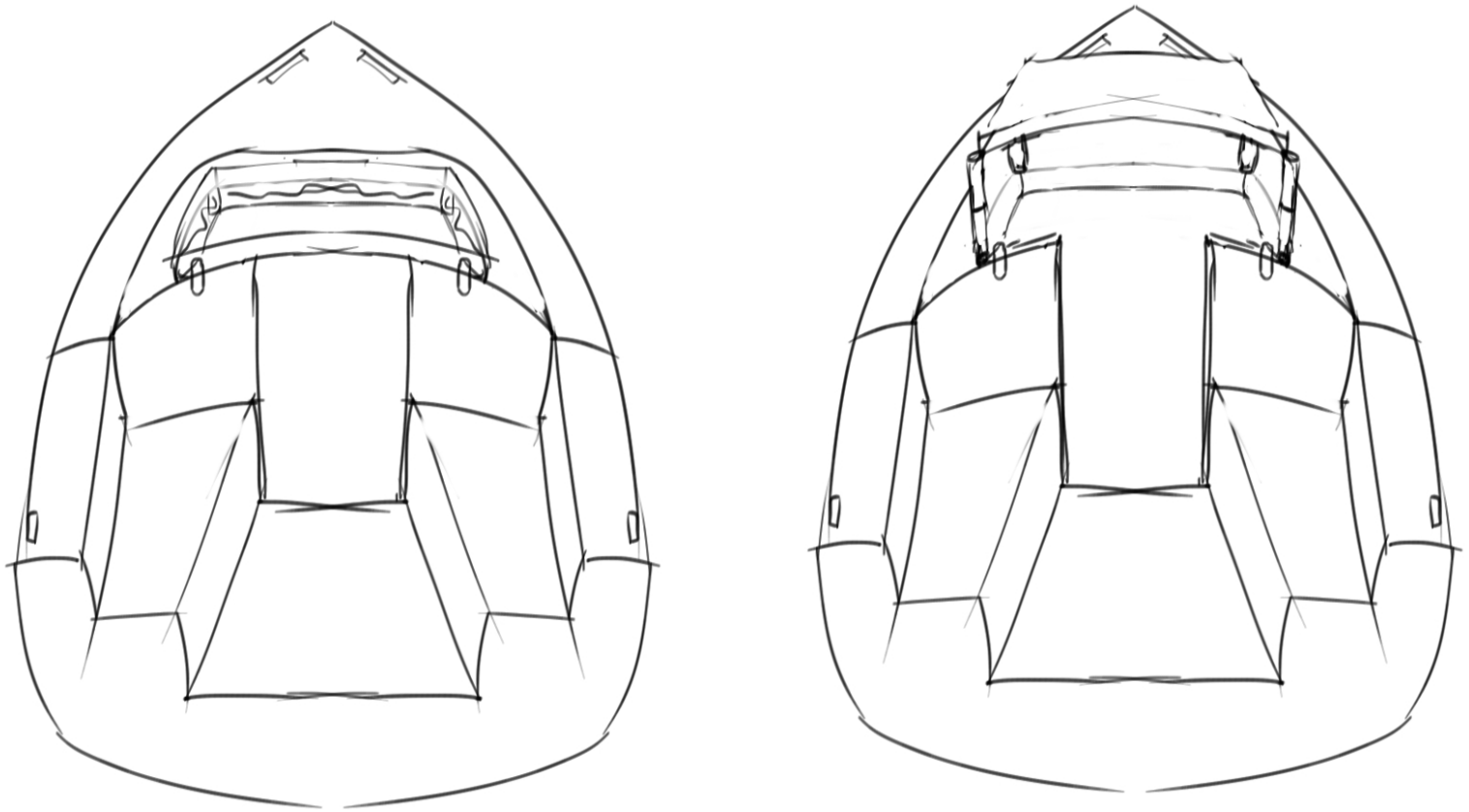


Fig. 9.11 Concept lifting roof

Concepts choice

Goals for the opening:	Ease of operation	appearance	comfort	Space perception
Large opening	+	0	0	+
tent	-	0	0	+
Lifting roof	-	-	-	+

Goals for the cooking:	Ease of operation	appearance	comfort	Space perception	Cooking inside and outside
Kitchen inside	+	0	+	-	0
Sliding kitchen	-	+	+	+	+
Kitchen outside(tent)	-	-	-	-	+

Goals for comfort outside:	Ease of operation	appearance	comfort	Space perception	Sporty feel
Fold away backrest	0	+	+	+	+
Inlay cushion	+	-	+	-	-

Goals for comfort inside:	Ease of operation	appearance	comfort	Space perception	Flexible use	headroom
Round bench	+	+	+	-	-	+
Folding bench	-	+	0	+	+	-
chairs	+	+	+	+	-	+

-: bad influence
0
+: good influence

From the concepts one whole concept was generated, the concept with the chairs inside was chosen because of comfort. The cabin has a very wide opening which is closed by a zipper in cloth. There is also an additional spray hood to shelter the opening. This folds away in a ridge. There will be a sliding kitchen, but this will not include a storage locker opening. Because of the large opening this would be double and since the exterior also has fold-up backrests it would degrade the ease of operation drastically to put two moving parts on top of each other. The slider kitchen slides over an extra interior bench so that there will be an extra sleeping facility and seating space. This gives some flexibility in usage.
One of the indoor seats is placed on a sliding rail. If you slide the seat back there is a toilet underneath. The other seat cannot move, only rotate because of the added bench for flexibility.
Because of the large opening the toilet is placed far forward for more privacy and to make sure there is a ceiling over the toilet.

10 Measures and sizes

After having chosen the concept and choice of the components and placements, Solidworks was used to see if the sizes and placements would really work. It was found that sliding the chair over the toilet would result in the seating being too high. The heigh of the toiletcover would be approx. 600 mm from floor level. This is a suitable height for a side table, so it was decided to make a side table-like compartment. Now the toilet will be covered with a hatch which is the tabletop. when opened the hatch provides some privacy for the toiletting.
In fig.10.2 the first sketches of measures can be seen. The measure drawings range from 7,5 m to 9 m. the exterior is kept at 2 meters in these drawings. It was decided that this measure could be bigger so the exterior would feel more roomy. It is chosen to go with a length in between the 2nd and 3rd drawing. Therefore the length of the design will be 8.3 m or 27 ft.

Fig. 10.3, 10.4 and 10.5 show the final measures of the interior. The appearance of the parts is not yet correct but this will be done later at the same time as the exterior design will be adjusted to the styling collages.

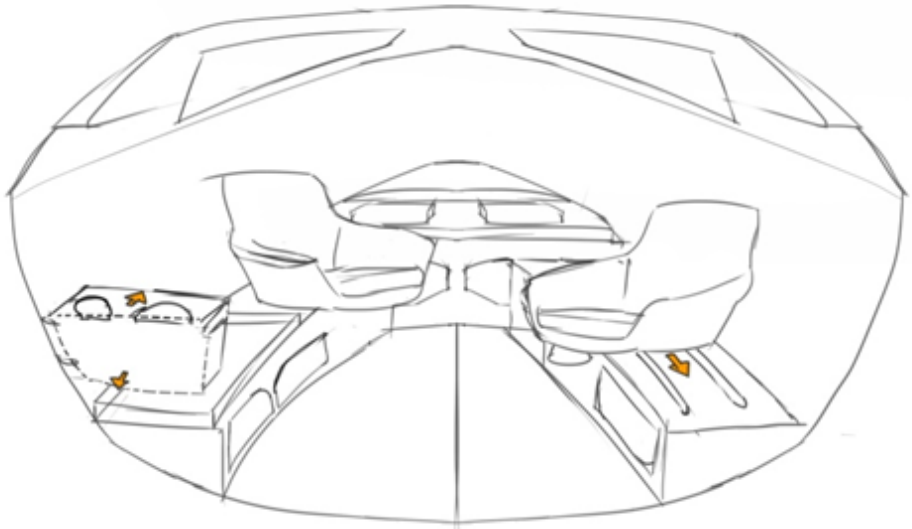


Fig. 10.1 Final design

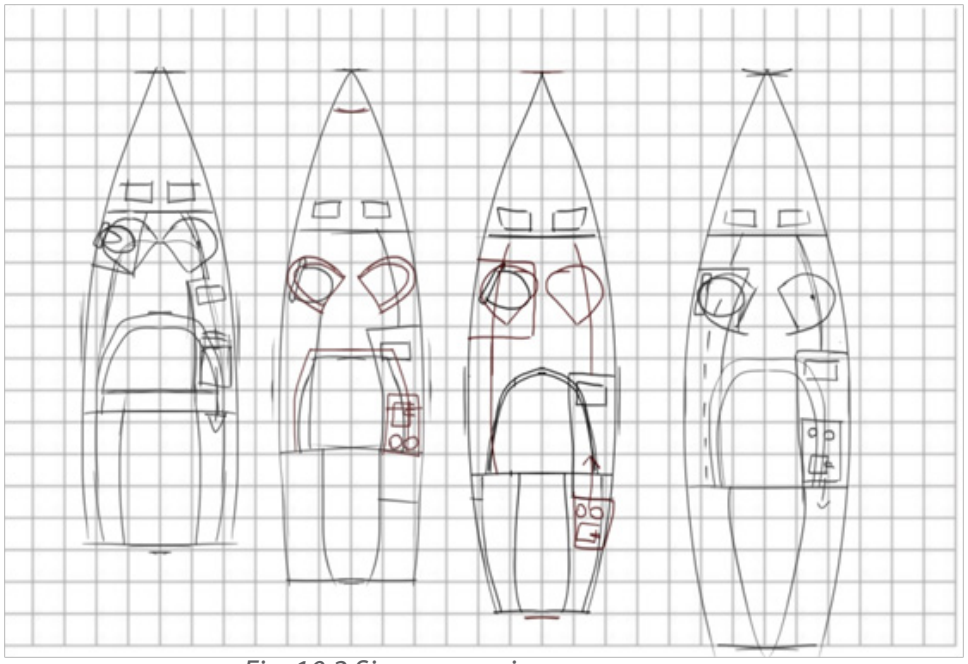


Fig. 10.2 Size comparison

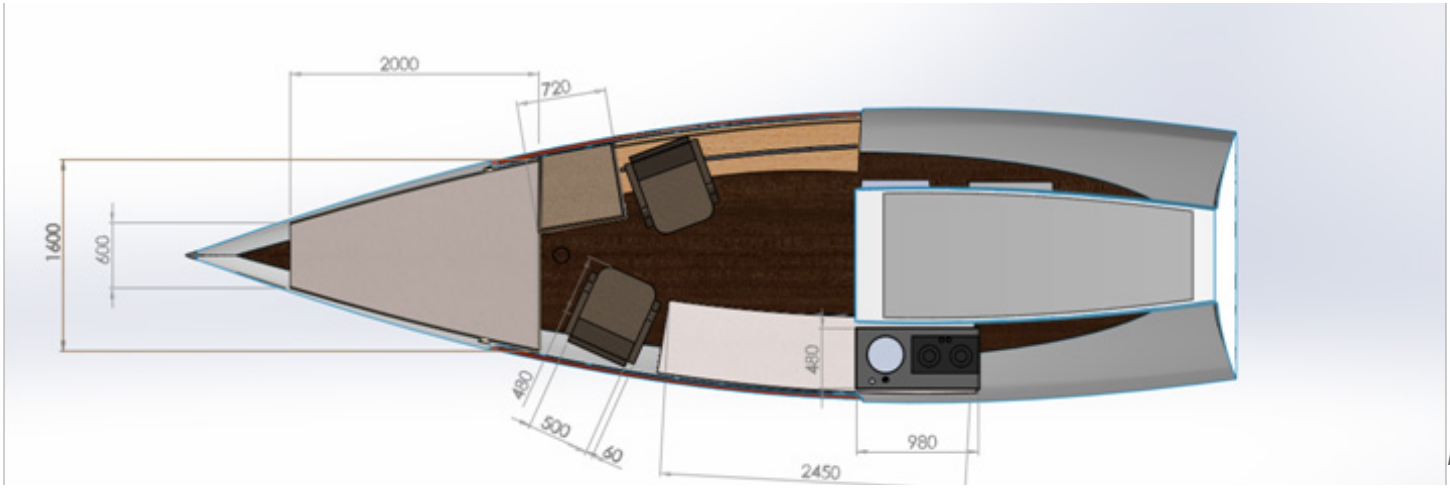


Fig. 10.3 Final sizes top

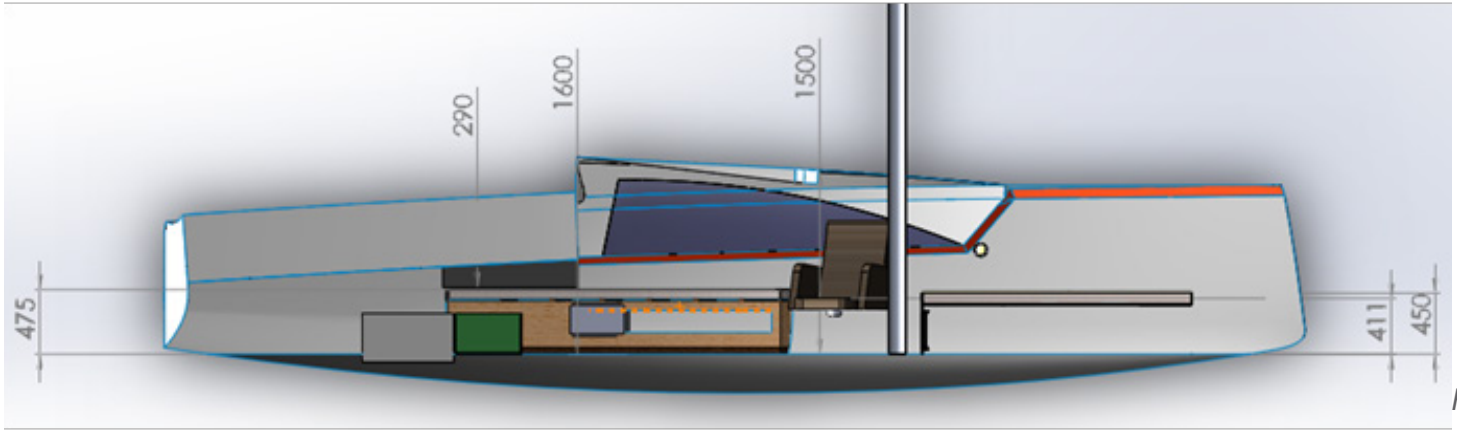


Fig. 10.4 Final sizes Left

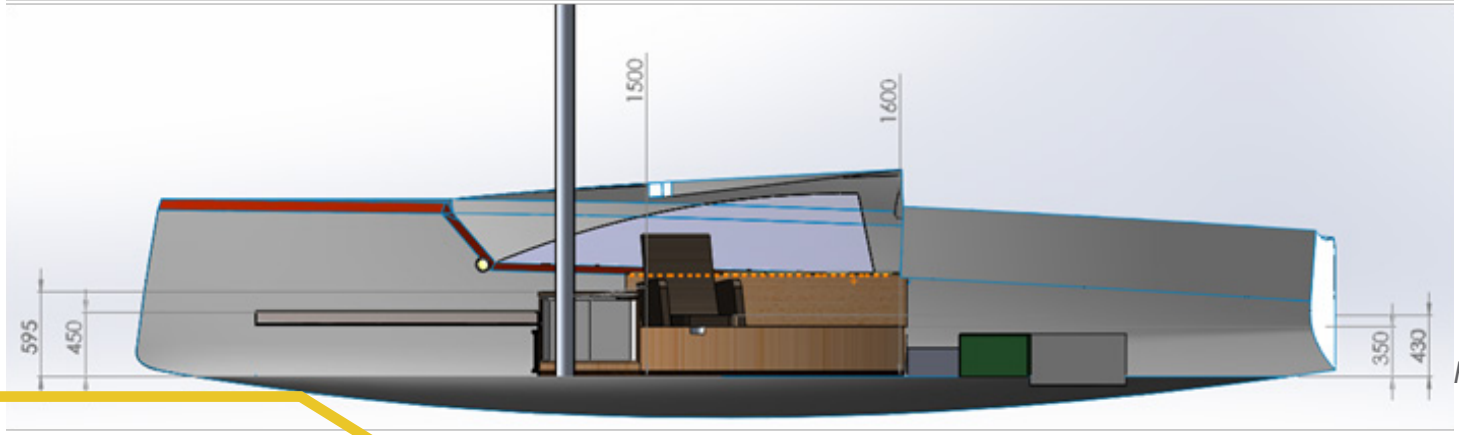


Fig. 10.5 Final sizes Right

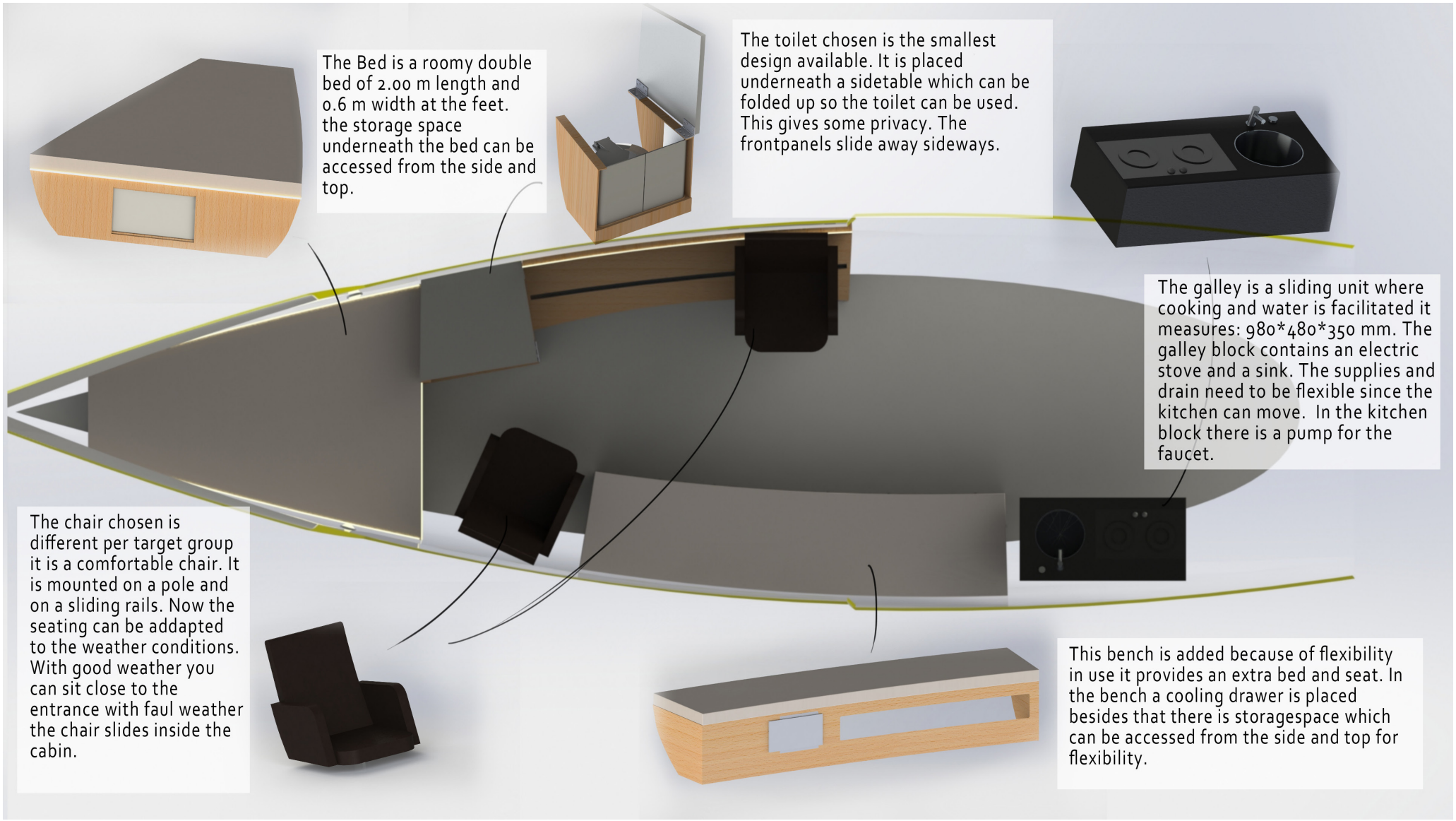


Fig. 10.6 Interior design

Parts

First the parts for the wealthy thirties were sought out, next the adjustments for 50+ are made. For a description of the components can be looked at appendix I parts.

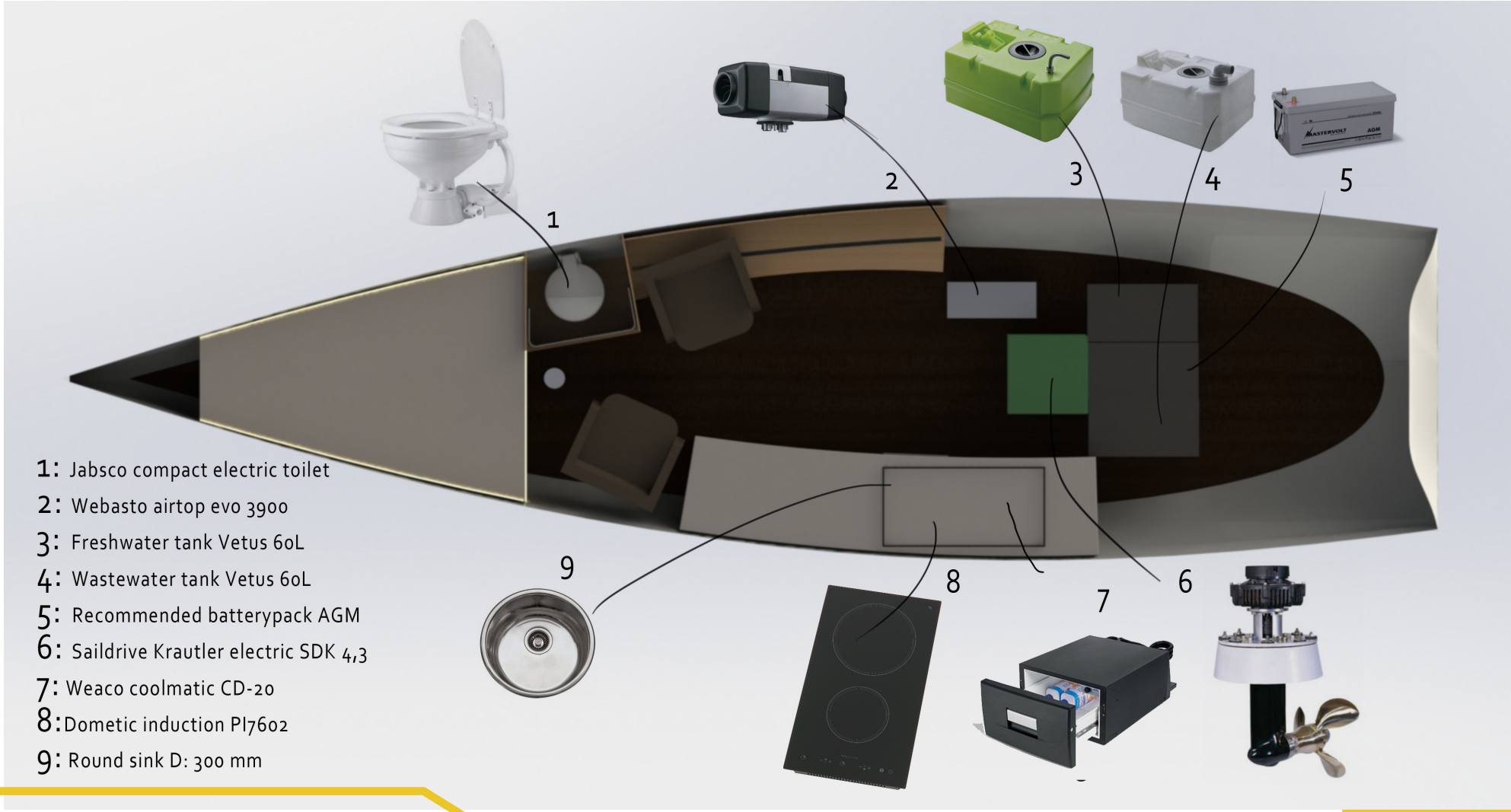


Fig. 10.7 Parts interior design

For the 50+ group some adjustments in the parts are made: for the electric saildrive a diesel saildrive is placed. A diesel tank is added and the electric cooker is replaced with an alcohol cooker.

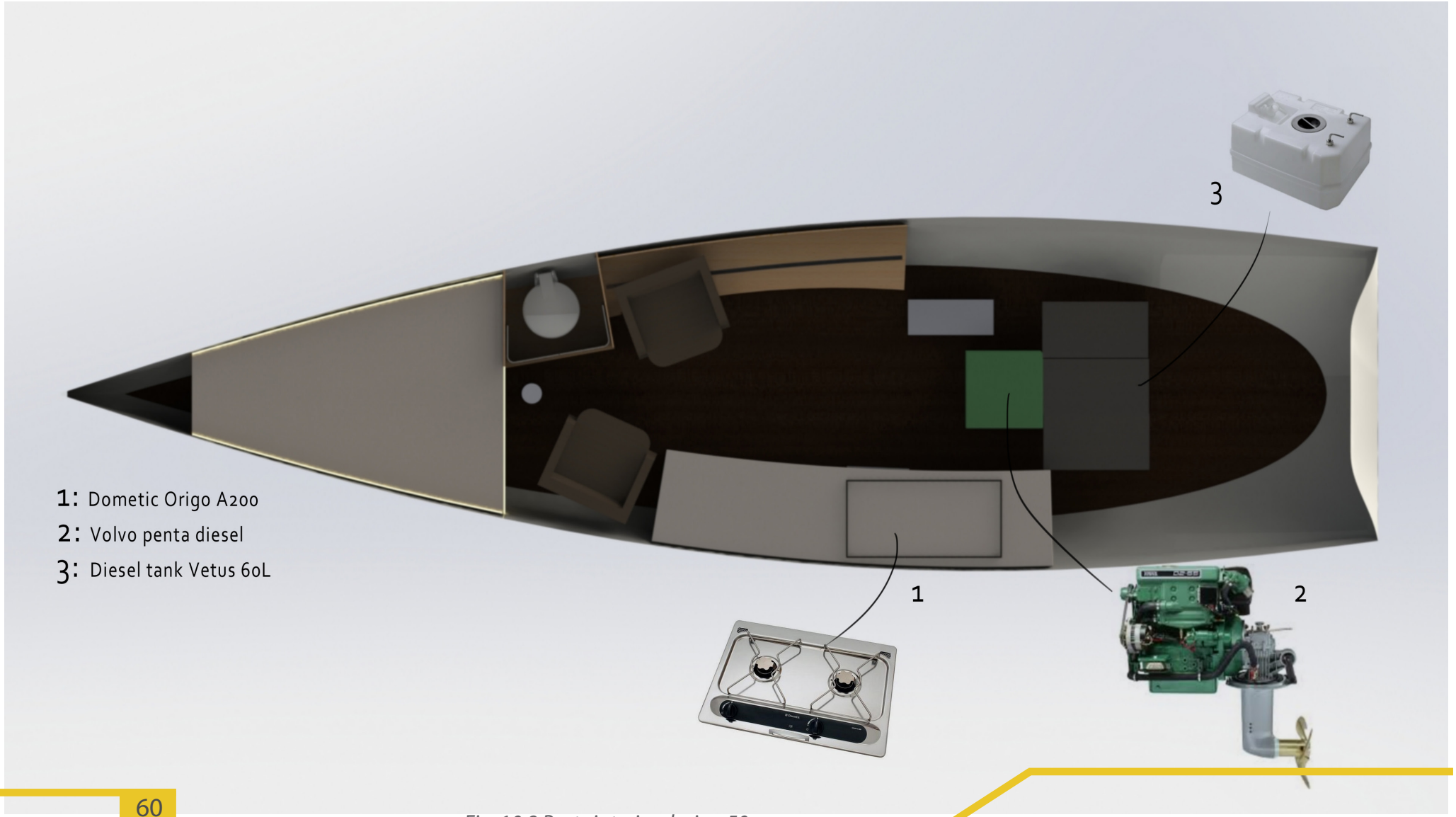


Fig. 10.8 Parts interior design 50+

Lighting

In the interior design lighting is placed. The normal lighting is done with LED strips but at some point more light may be needed, therefore fixed light points are placed as well. Near the chairs for reading, near the kitchen for cooking and above the bed as a night light.
in fig. 14.4 and 14.5 you can see an example of respectively led strip lighting and fixed lightpoints.

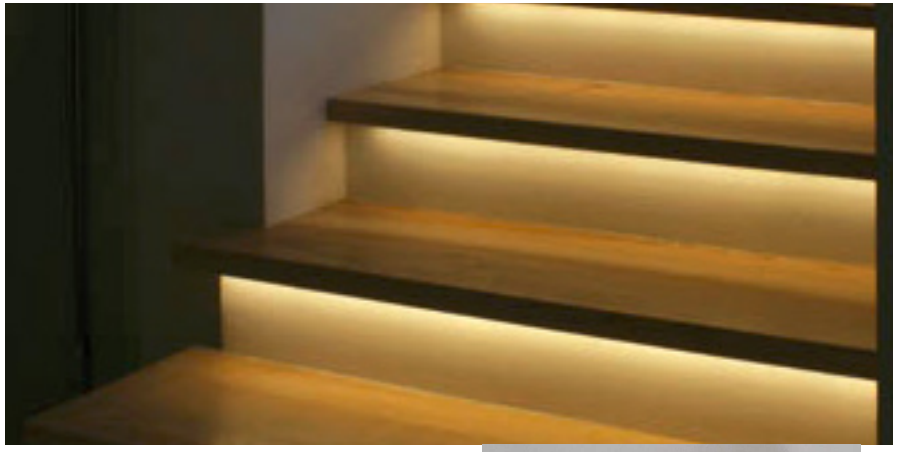


Fig. 10.10 Led strip lighting

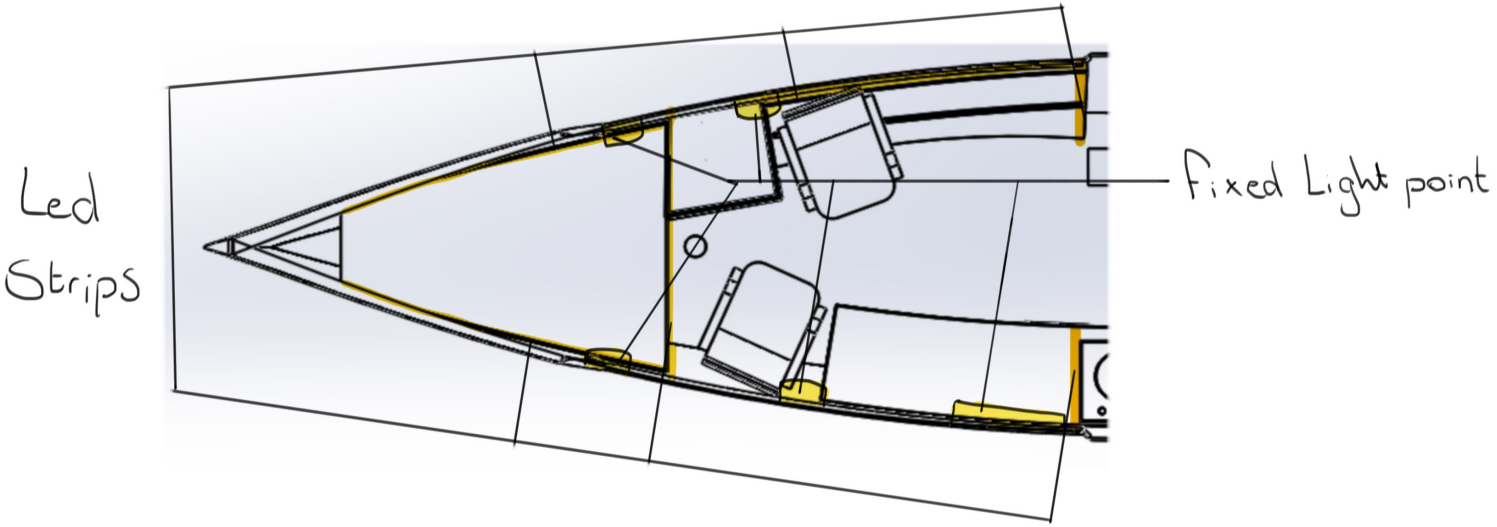


Fig. 10.9 Lighting

Fig. 10.11 Fixed light point

Storage

In front of the bed some space is left. this will be filled up with storage space, one compartment can be openend from outside on the deck and is to store anchor and lines. The other can be opened from inside and can be used for storage of clothing.
Underneath the bed there is also a lot of storage space. This can be accessed from the front and the top to avoid having to redo the bed after having accessed the storage.
In the bench underneath the sliding kitchen there is an optional cooling facility and storage for food. This storage can be accessed from the front and the top to make it accessible even when the kitchen is located above the bench.

On the left side under the cockpit benches the kitchen slides on the right side there is once again storage space this space is best suited for sailing equipement. It is big and close to the entrance. For smaller nick-nack and valuables there is a smaller storage in the backpanel of the slidingrail. At the bed there are some pouches for stuff as well.

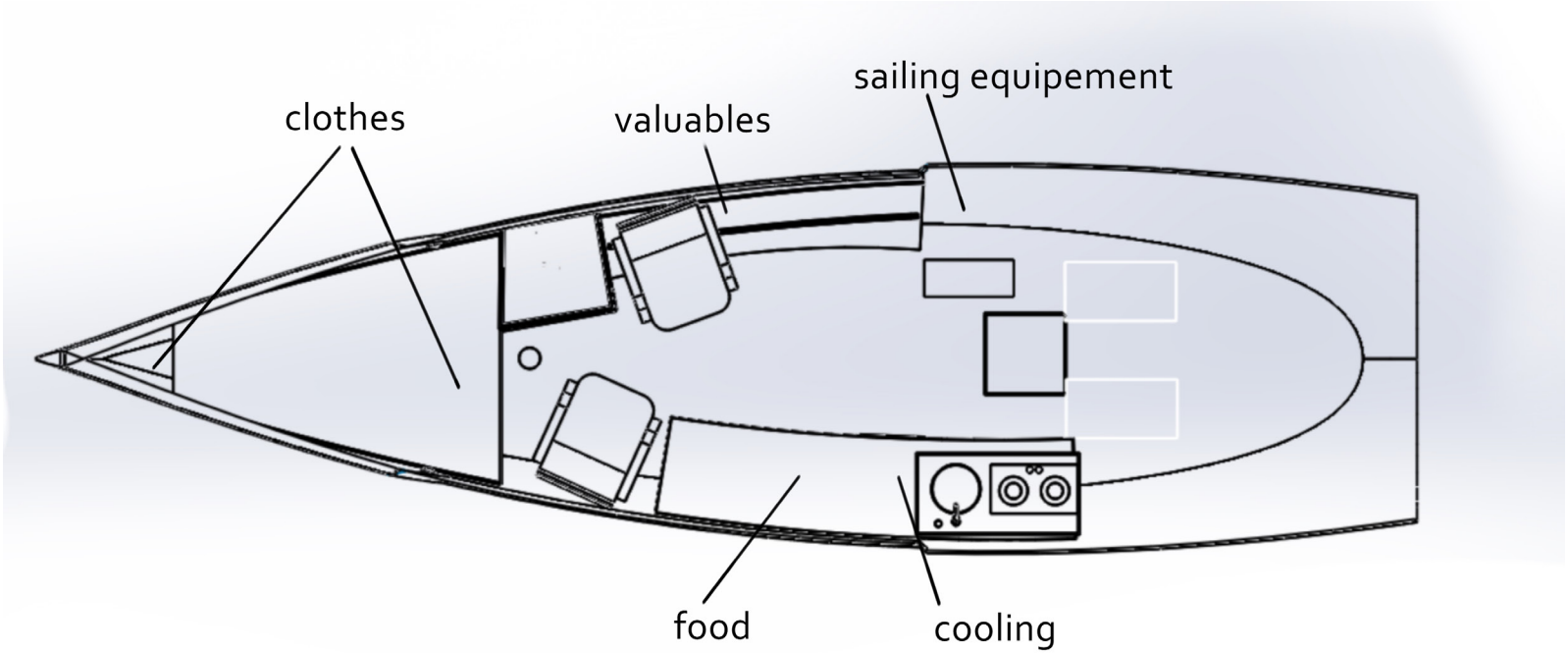


Fig. 10.12 Storage

Electricity

Here the electricity system is drawn up, in fig. 14.7 the standard electric and to the right in fig. 14.8, the adjustments for the 50+: without the 220 V and electric motor. The battery capacity needed is calculated in appendix J electricity. The capacity is: 318 Ah. This is only for the facilities, the propulsion and starting will be done on a seperate system. for the facilities a set of AGM batteries is opted, 2 batteries of 175 Ah are coupled. Li-ion is discarded because of the risk and the gel batteries for their lower capacities.

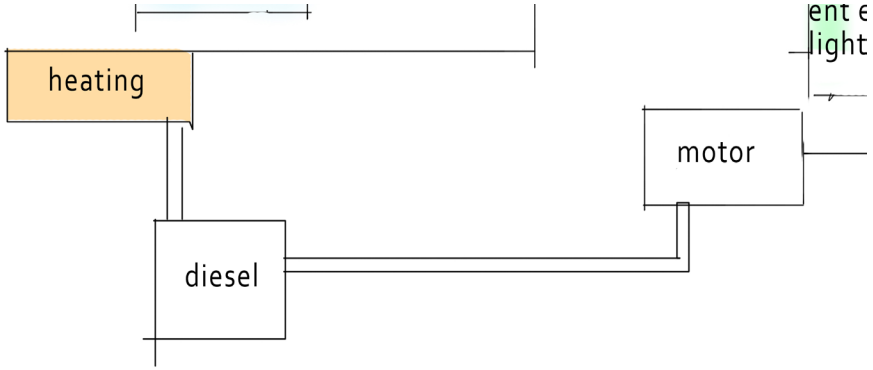


Fig. 10.14 Electric 50+

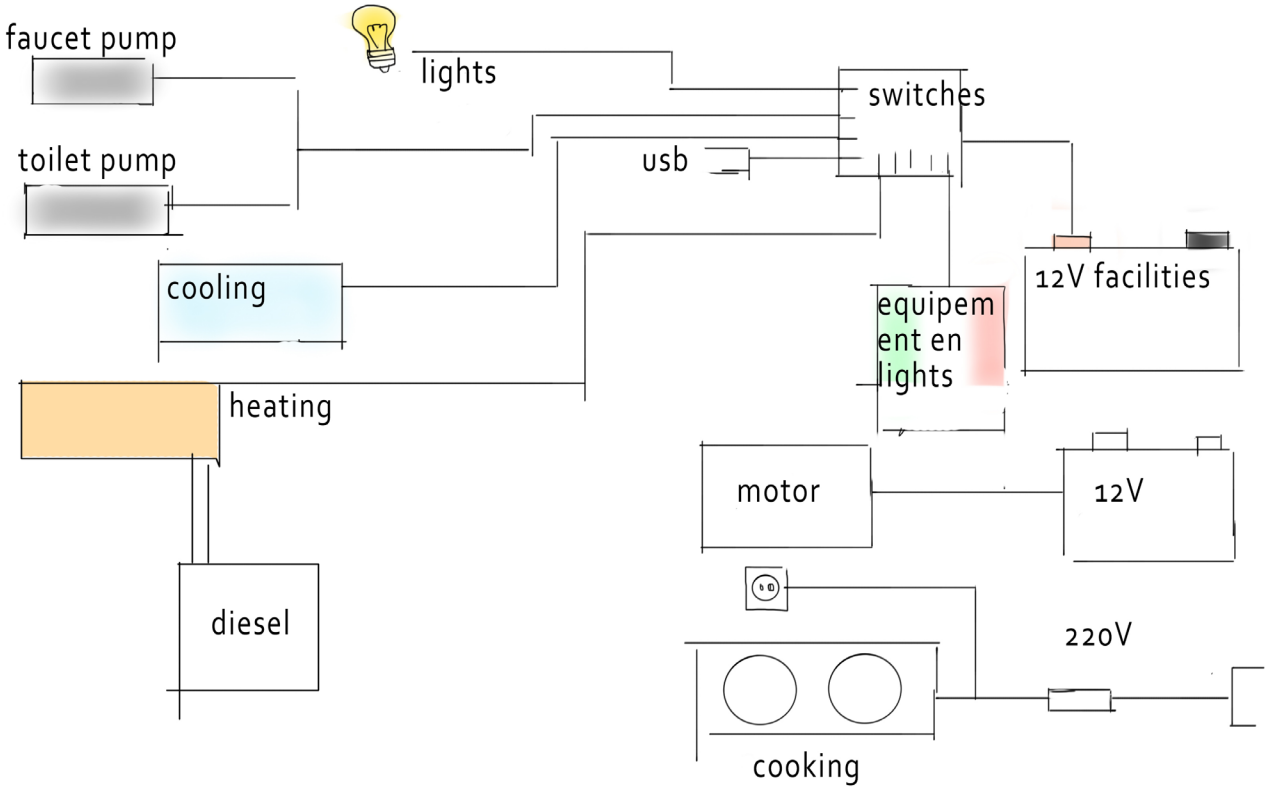


Fig. 10.13 Electric standard

Heating

The heating system in fig.14.9 is connected to the cabin with an outlet and connected to the outside with an inlet. The heater has a diesel inlet and a connection to the 12 V system for the control.

The water system consists of 2 tanks: a freshwater and a wastewater tank. The 2 water consuming facilities on board are toilet and faucet. They have their own pumps. The drains are connected to the waste water tanks, both tanks have an in- or outlet on the deck for emptying or filling the tanks. as can be seen in fig.14.10.

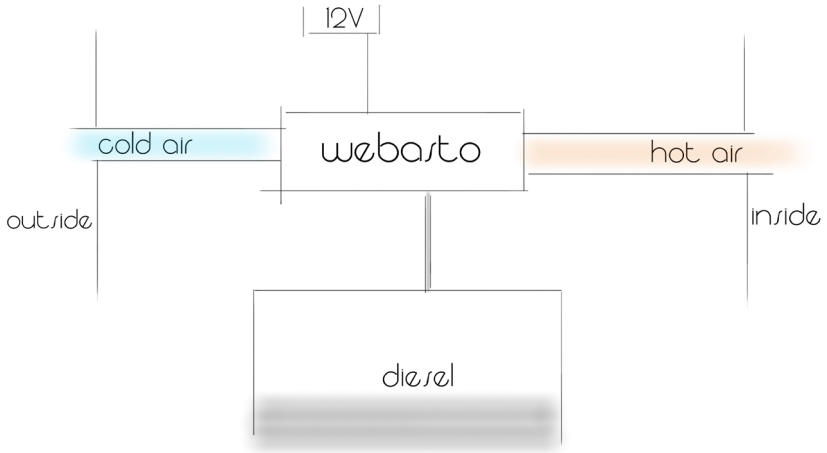


Fig. 10.15 Webasto heater system

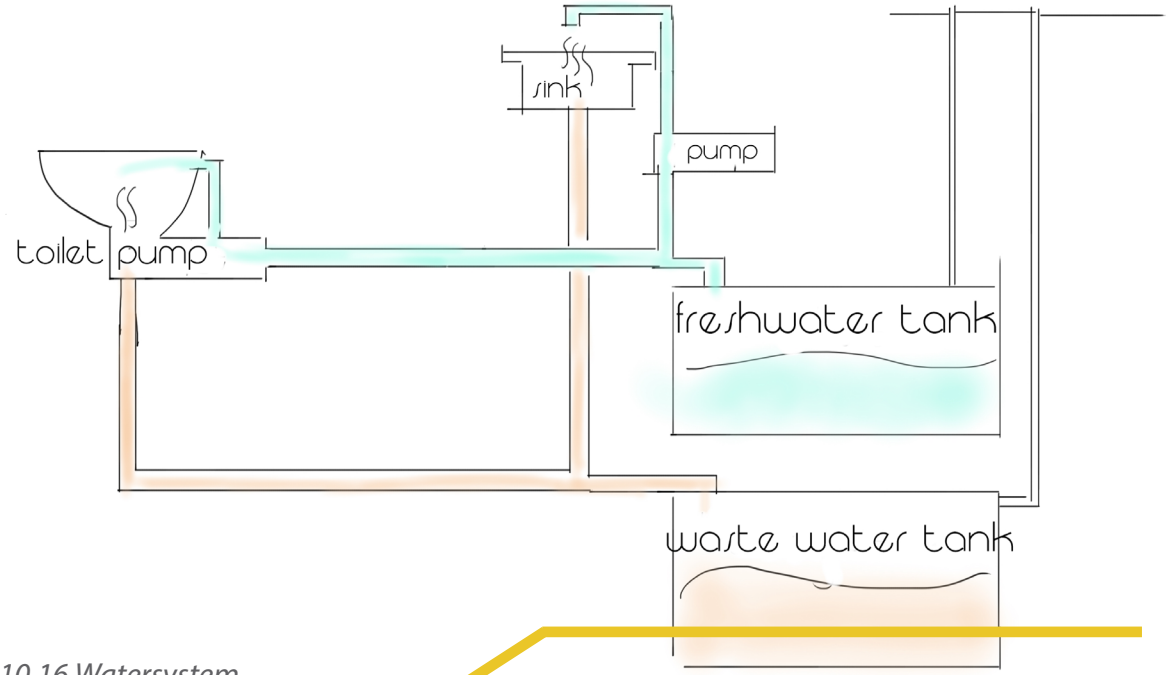


Fig. 10.16 Watersystem

11 Exterior Design

Since the interior design is now defined, the exterior design is further investigated. The interior design gives some measures, demands and-certain features for the exterior. A lot of sketches were made to explore the possibilities but it was hard to find the right appearance for the boat. The exterior is what you see at first glance and therefore is very important. There has been looked at concept cars for modern and fast shapes and designs. Also clay models were made. A final design was chosen in consideration with all target groups.
In fig. 11.1 the proportions and placement of the mast were investigated.After that some sketches were made with in the first series different superstructures and in the second series different hulls.

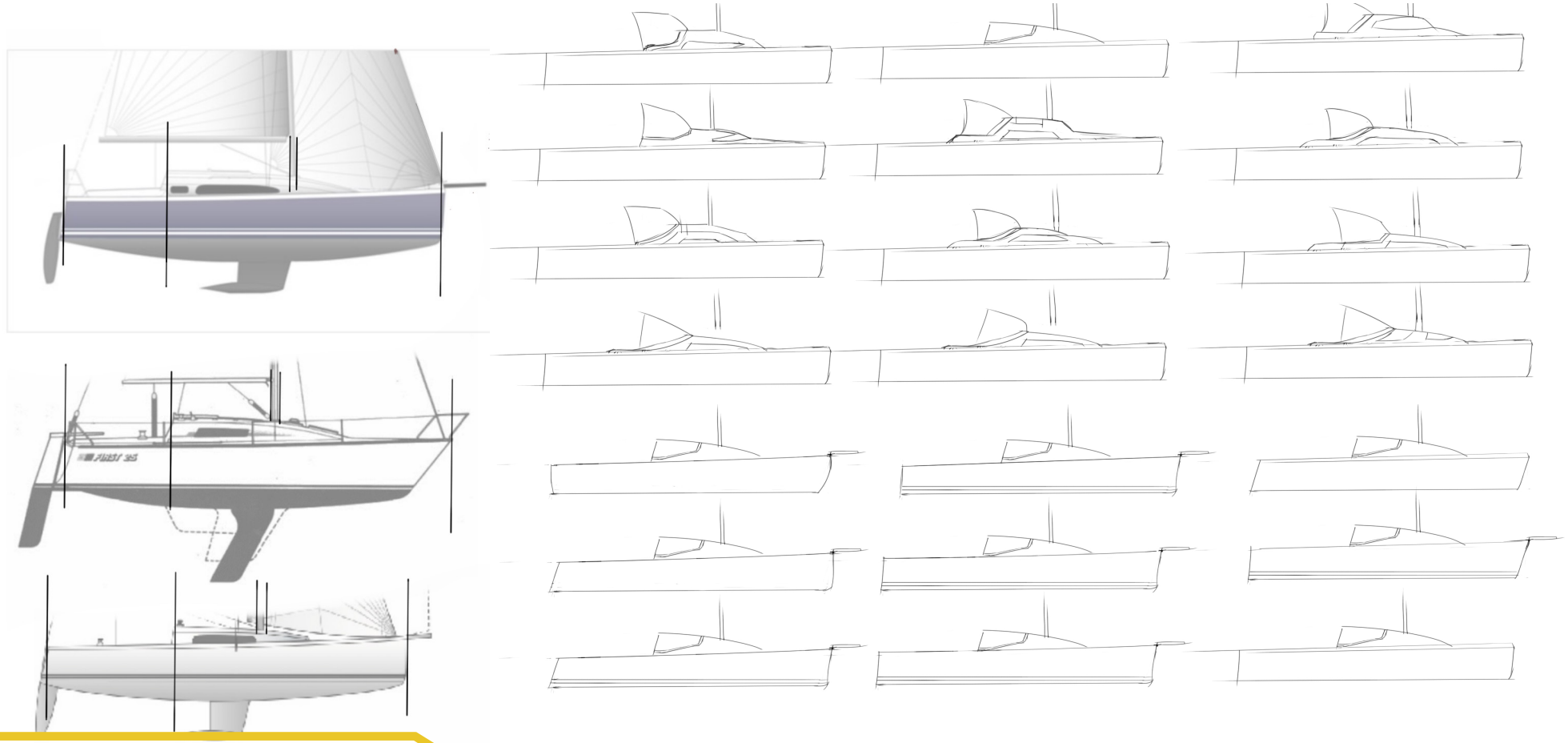


Fig. 11.1 Exterior design

Here sketches were made with tracing parts of cars, on the left of fig. 11.2 the actual tracings can be seen. The other sketches are based on the left ones.

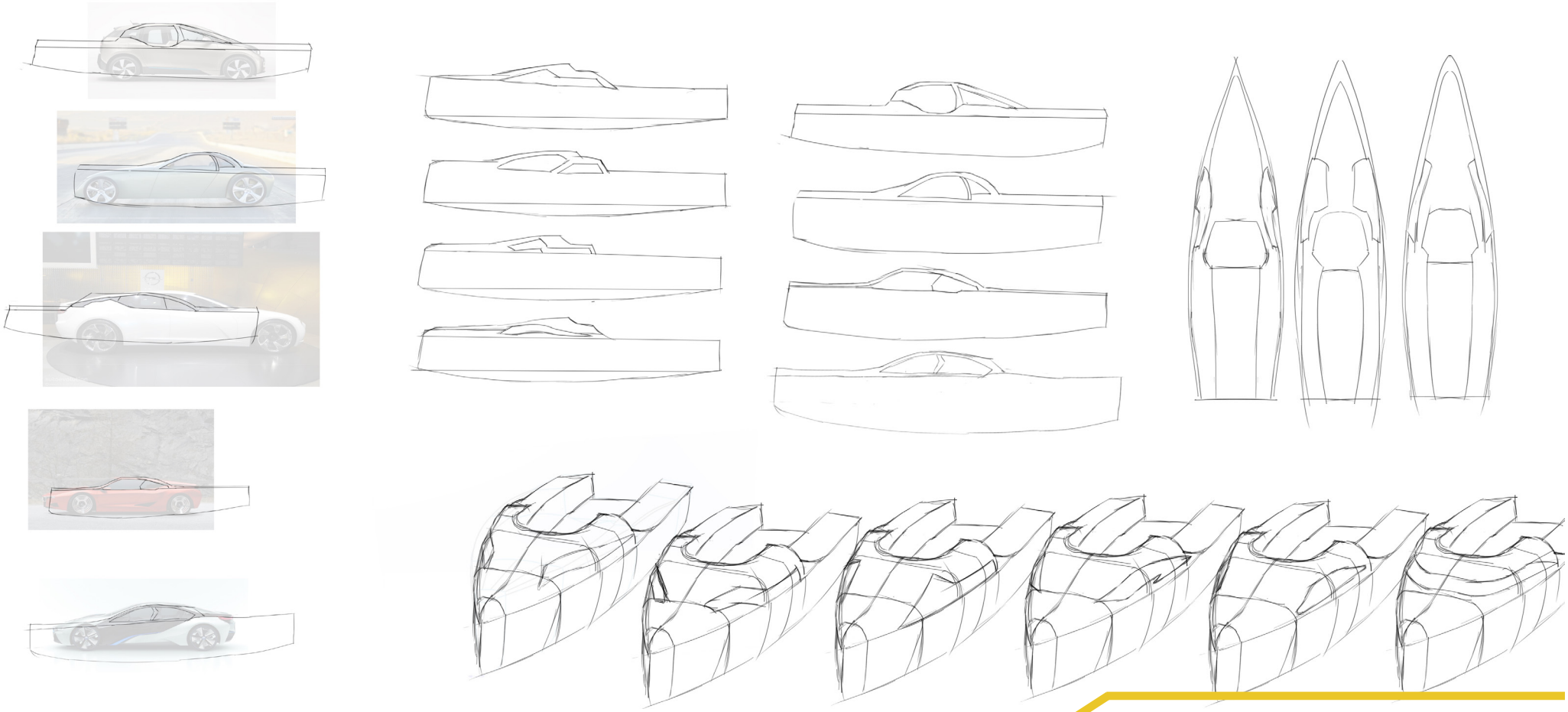


Fig. 11.2 car design sketches

In the sketches in fig. 11.3 first the stern and/or bow were sketched, then combinations were drawn in 3D.

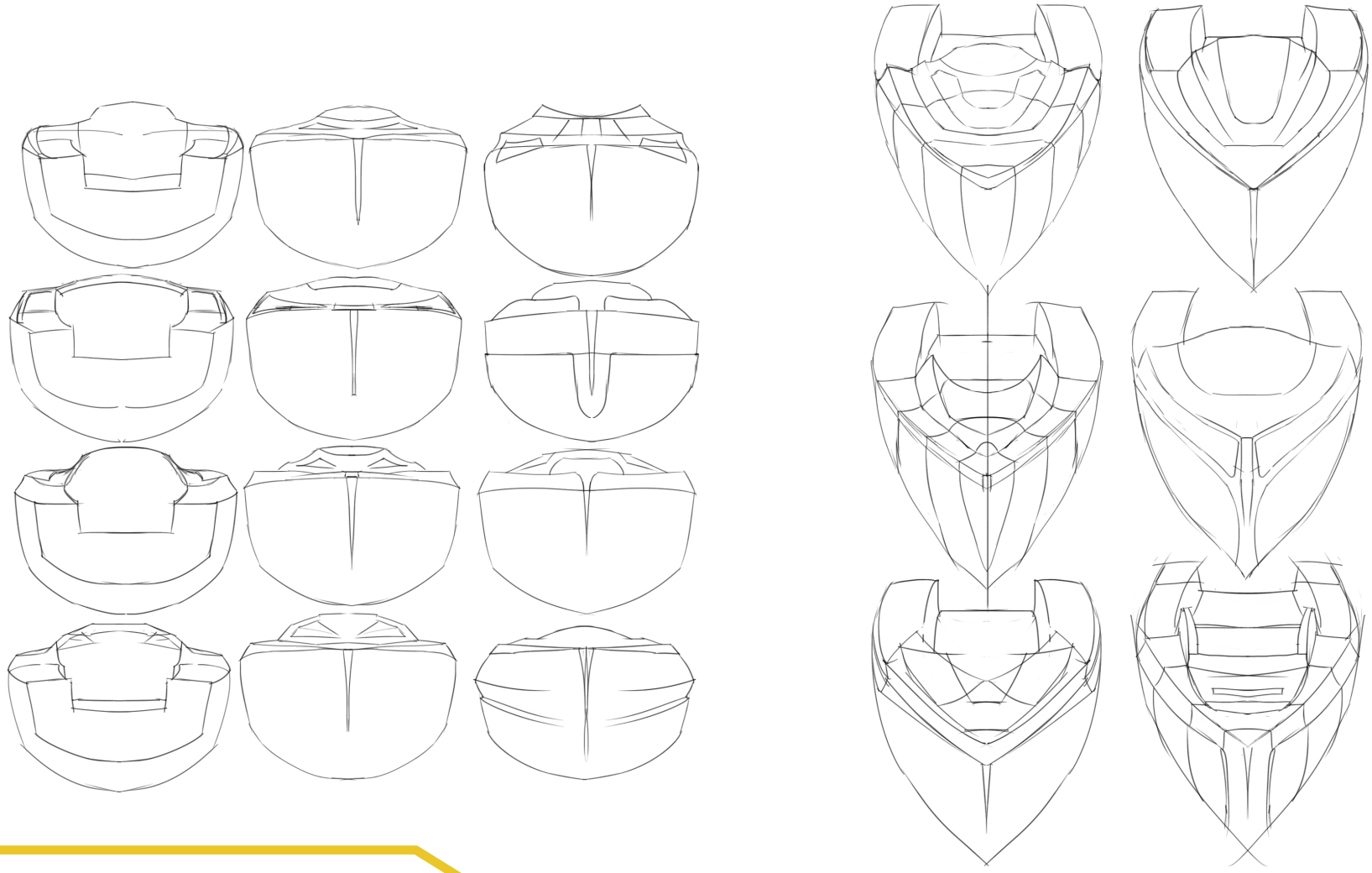
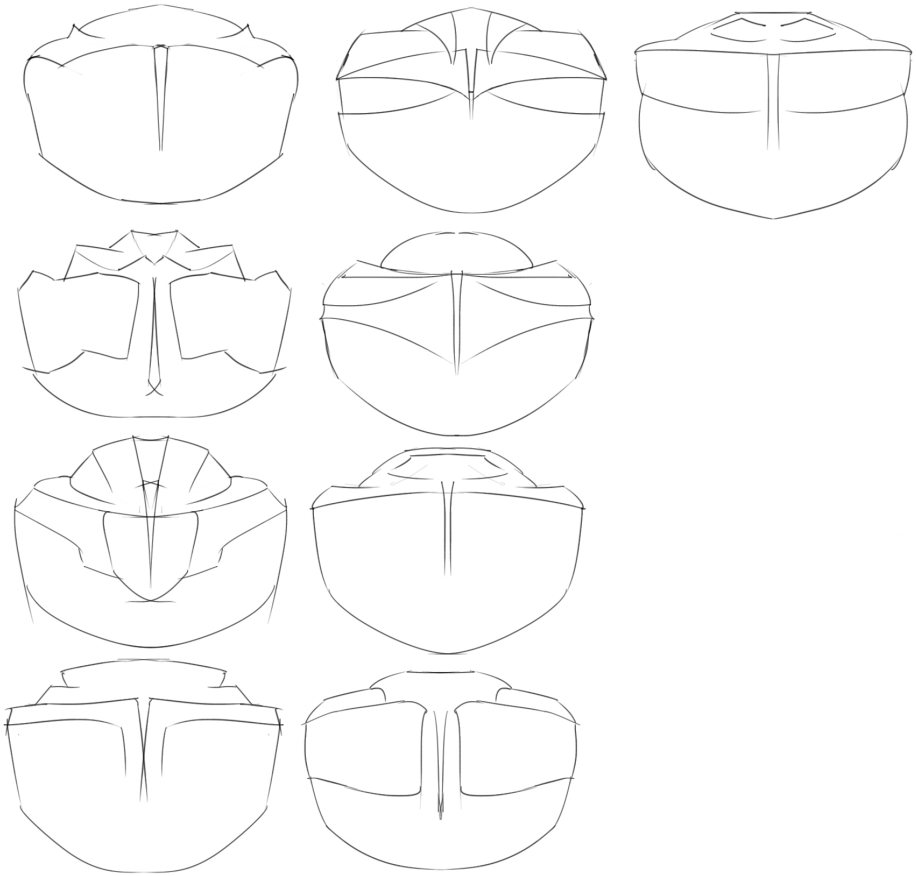


Fig. 11.3 Exterior design

Again some bows and 3D representations of them.



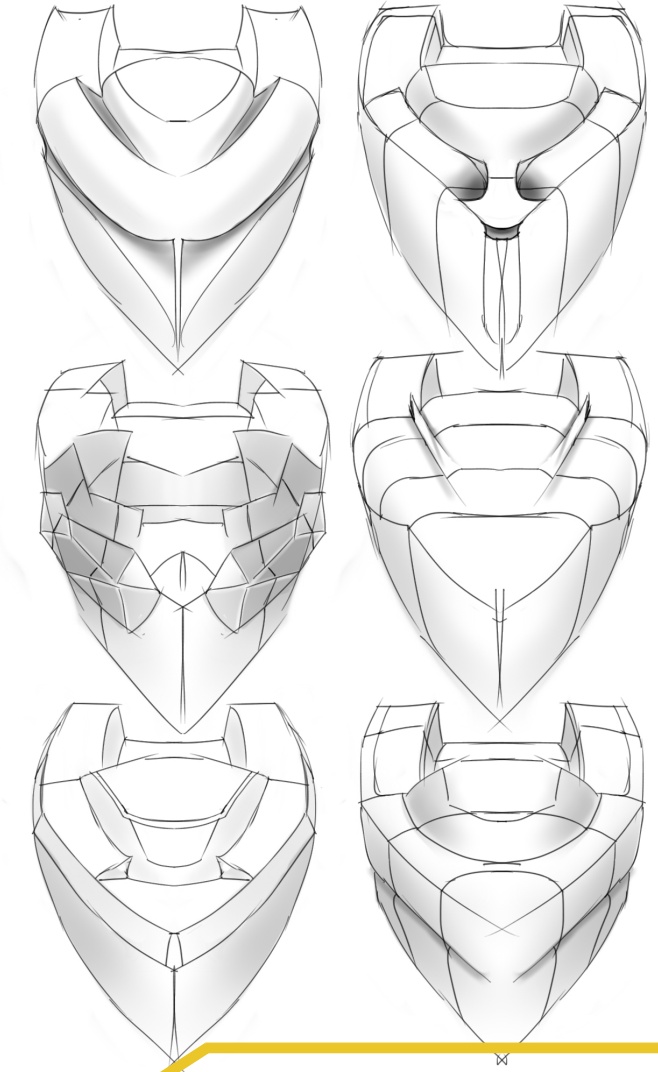


Fig. 11.4 Exterior design

These designs were based on the idea of making the boat appear closer to the water. when the boat appears lower it appears more sportive.
From these designs three were chosen to be further elaborated in a clay model.

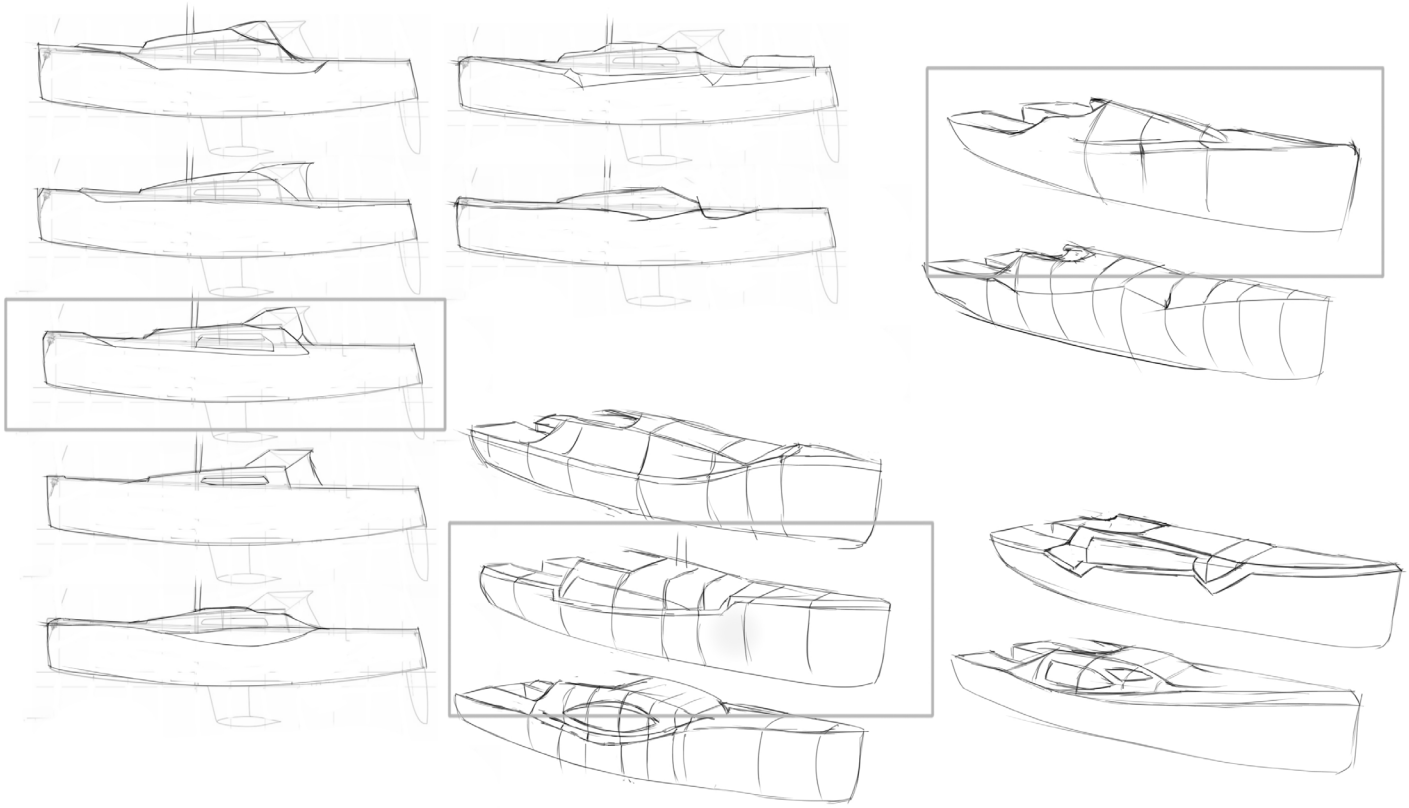


Fig. 11.5 Exterior design

Clay modelling

In clay three models were made from the sketches before, to see what they were really like in 3D. One of the three is chosen and further elaborated hereafter. Modeling the clay didn't work out as smooth as hoped for but the shapes can be seen and judged.

Fig. 11.6 Exterior design

These are the three elaborations made with the claymodel as a base. The green one is picked to further elaborate, because this one gives the fastest appearance. When looking at the style collages it can be found that the target groups don't want a very organic shape.

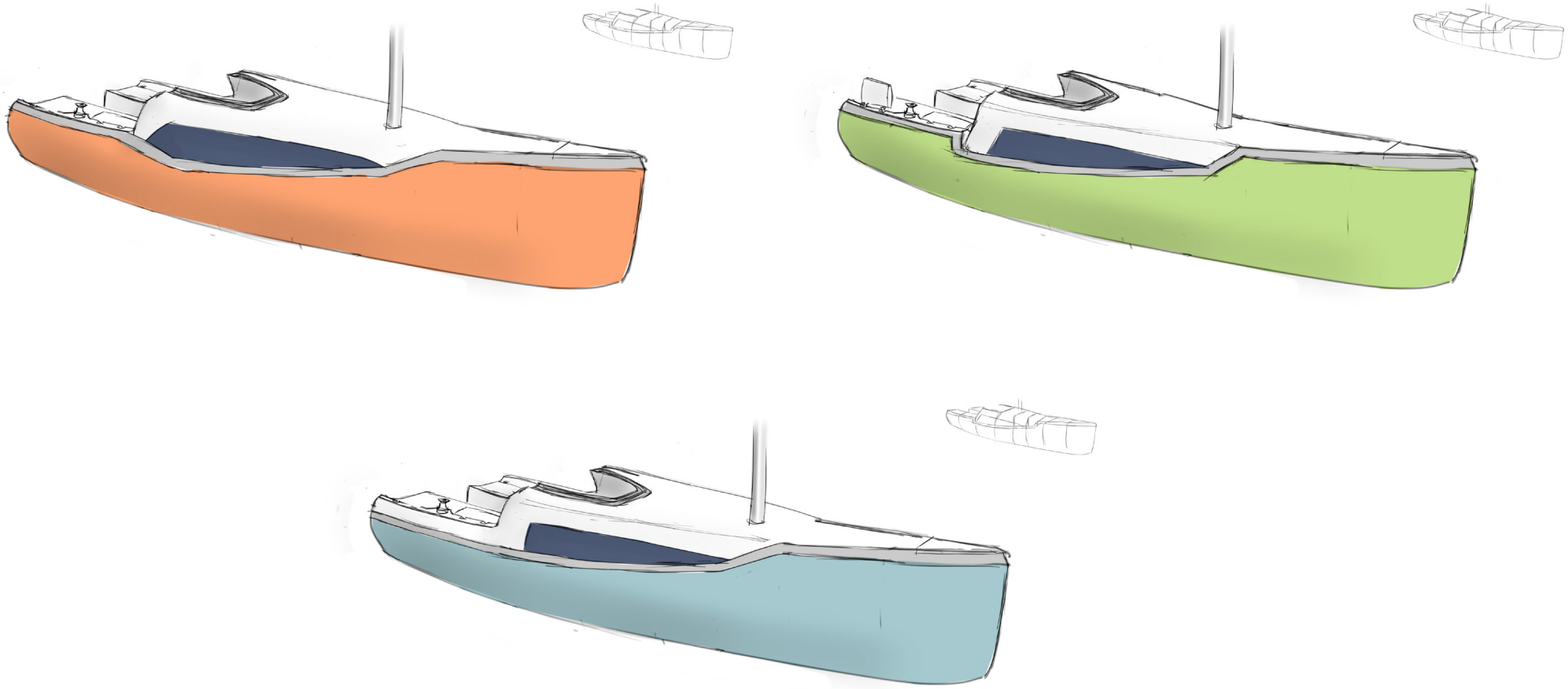


Fig. 11.7 Exterior design

12 Final design

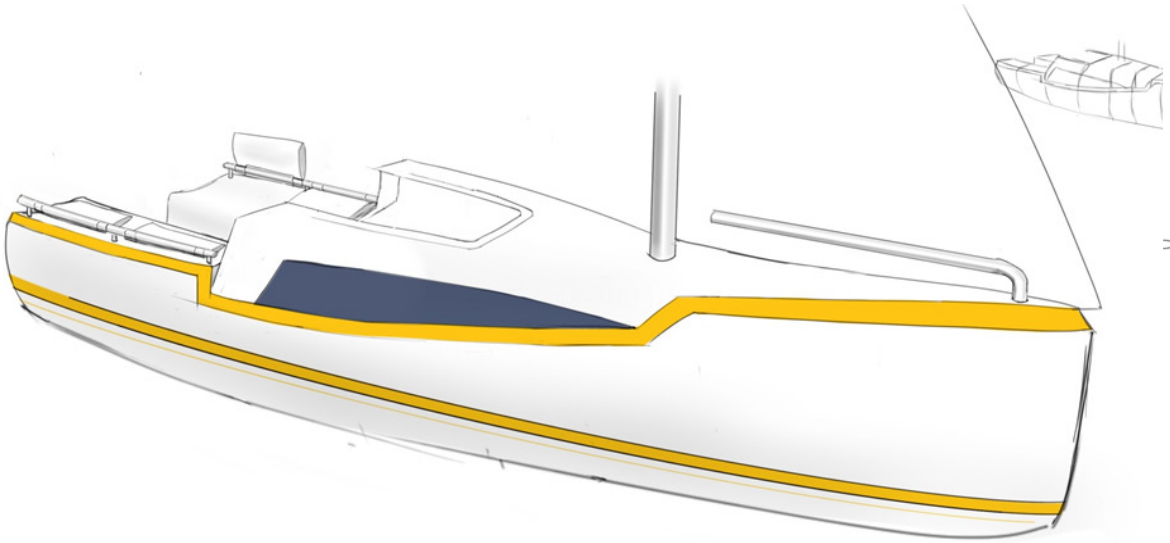


Fig. 12.1 Final design

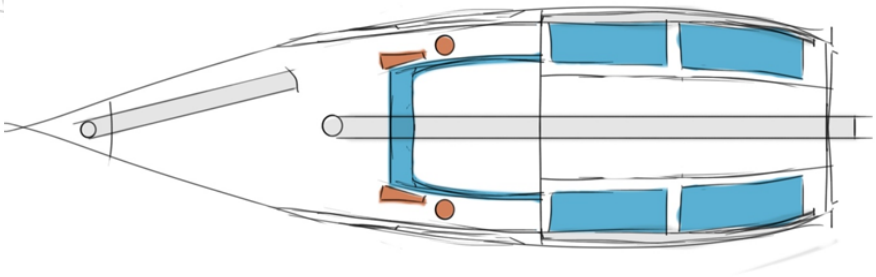


Fig. 12.2 Final design

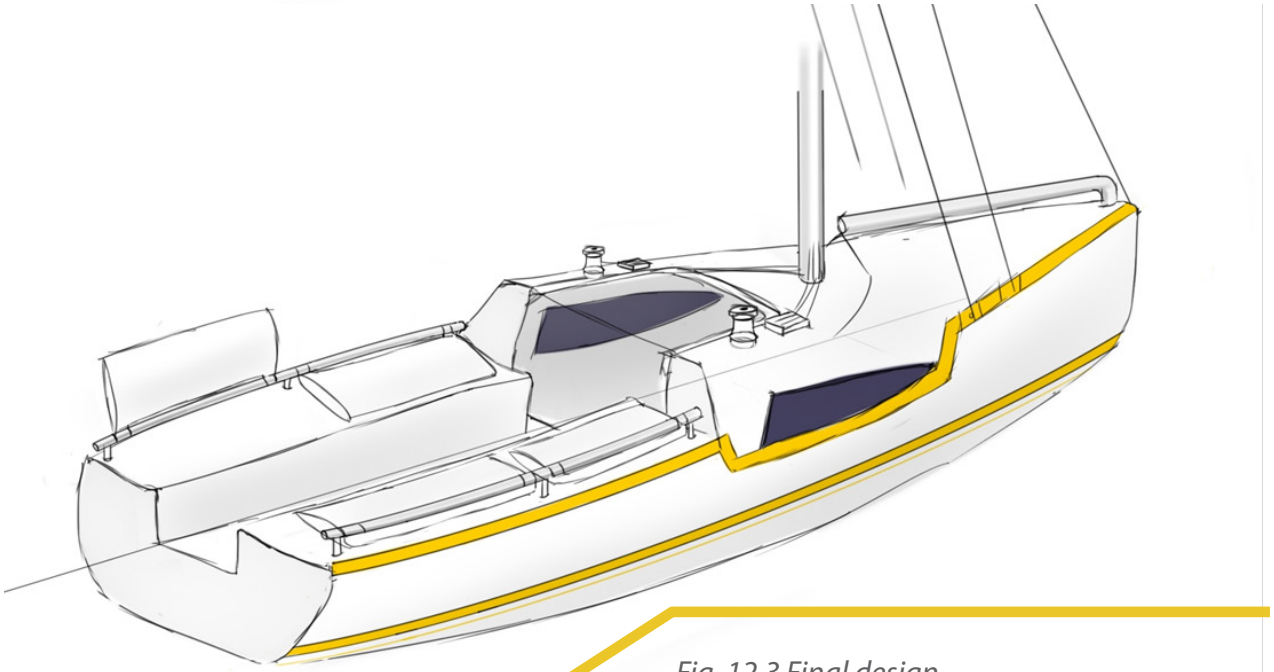


Fig. 12.3 Final design

Detail design

On this page some drawings and sketches can be seen to further clarify the parts special to this design.

The fold away backrests have a slightly convex shape where the polyester seating has a slightly concave shape. The backrest is made of a metal suport bar and foam for a comfortable seating. because of the foam, sitting on top of the backrest is still comfortable and because of the concave shape of the bench the two parts fit perfectly together. The backrest is mounted on a bracket with hinges, the hinges allow rotation over 100 degrees(see fig.). The bracket has a double function it is also the rear cleat (for the lines to the shore).

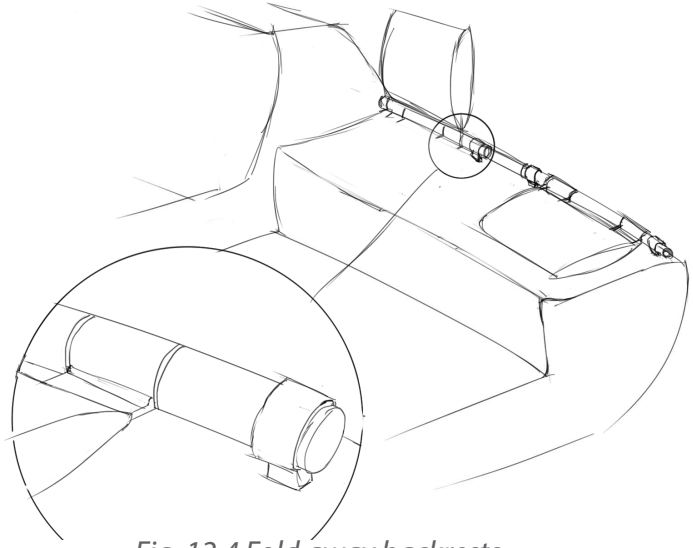


Fig. 12.4 Fold away backrests

The Galley is also a part that differs, it slides on drawer sliders. These are mounted on the side of the cockpitbench and on the side of the hull a shape is made to ensure a straight surface on the hull side. In fig. 16.5 the measures of the galley and the parts in the galley can be seen. The slider rails slide forward and backwards to make sure the whole length of the bench can be used for sleaping. The reach of the sliders is therefore 900 mm on each side.

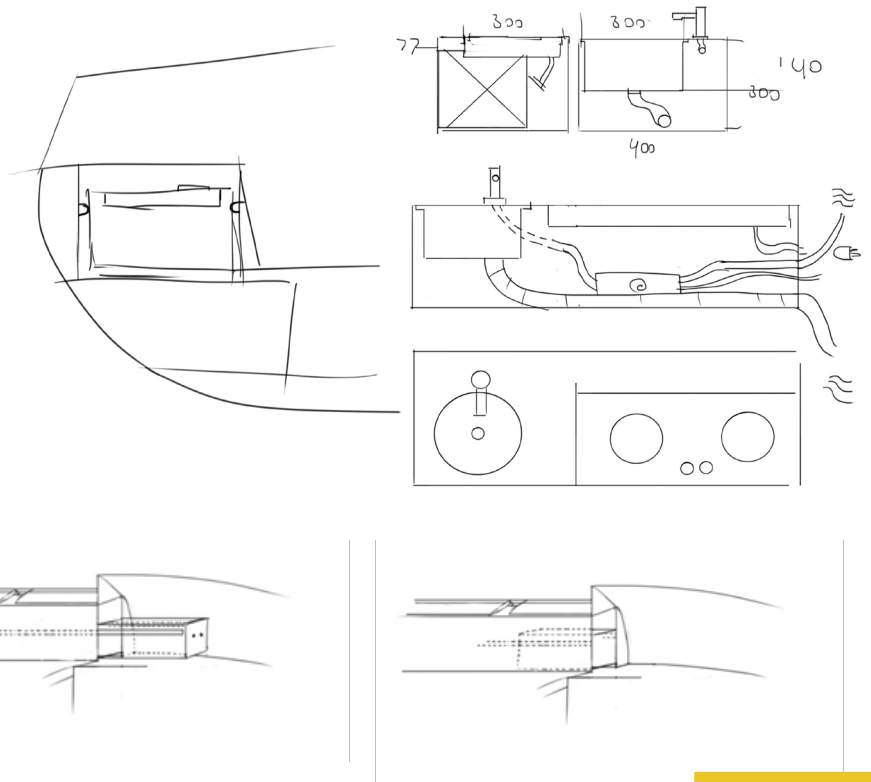


Fig. 12.5 Galley

The toilet has a casing of a side table. When folding up the table it forms a partition between the toilet and the rest of the boat see fig. 12.6. The hinges hinge over 90 degrees and the toilet is placed on a raised platform to ensure a more comfortable seating height and sufficient space for the plumbing of the toilet. Since the toilet has a height of 350 mm the platform is 100 mm heigh now the toilet has seating-height of 450 mm, which is more comfortable than before. The front of the toilet compartment is closed with sliding doors.

The rotating and sliding chairs: the chair design can be chosen but the standard part where it is mounted on is the same for every design. The sliding part and the rail can be seen below on the right the turning construction can be seen below on the left. Both are typically available parts see fig. 12.7.

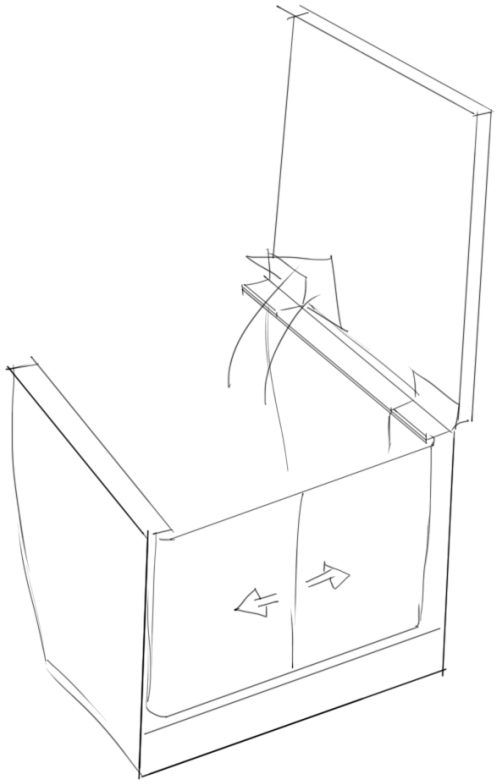


Fig. 12.6 Toilet unit

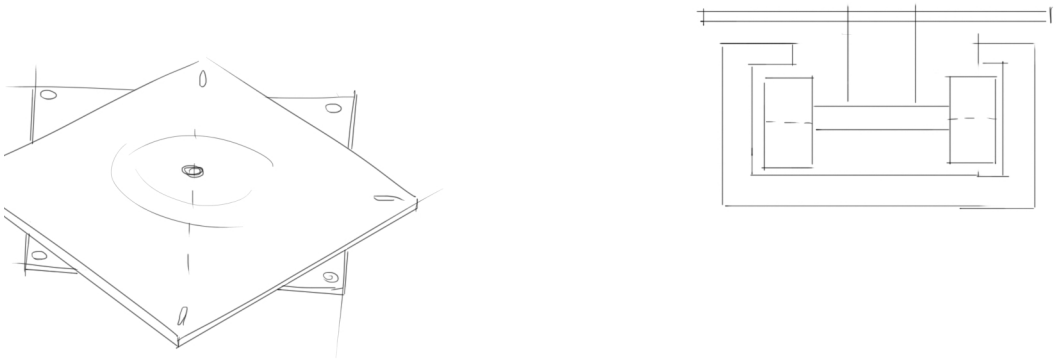


Fig. 12.7 Sliding rotating chair parts

Rigging choices:

A hoytboom is mounted on the foredeck, with a 100% furling jib. This is because of the easier use just as the lazy jack. The lazy jack is an option and not included in the basic design such as the hoytboom is. The keel won't be retractable because this costs too much interior space. A sprayhood isn't included in the basic design but can be added to shelter the entrance and part of the cockpit. For the steering features the standard will be a tiller with an option for a wheel. The rigging is standard aluminum with an option for carbon. The sails are regular dacron with an option for laminate and squaretop. in fig. 12.8 a proposal for the rigging can be seen.

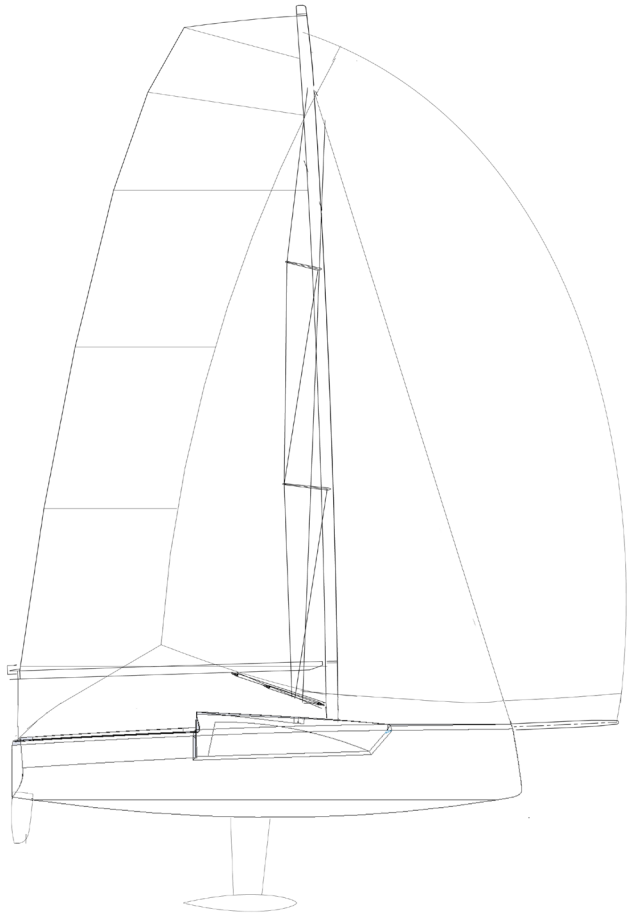


Fig. 12.8 Rigging

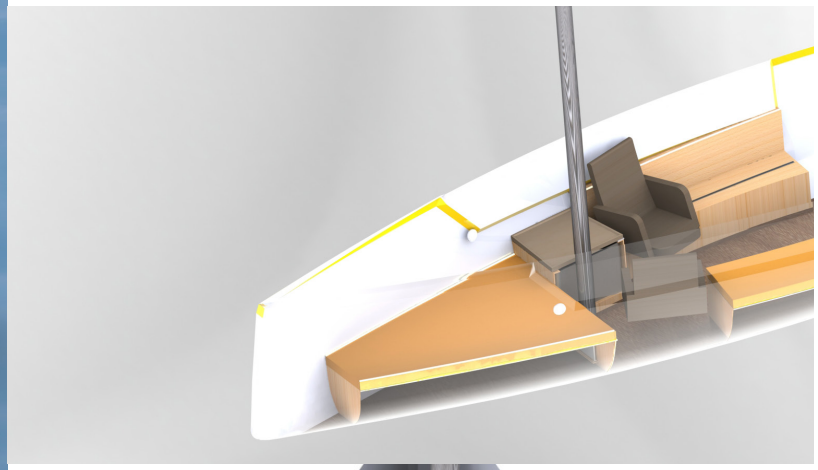
50+

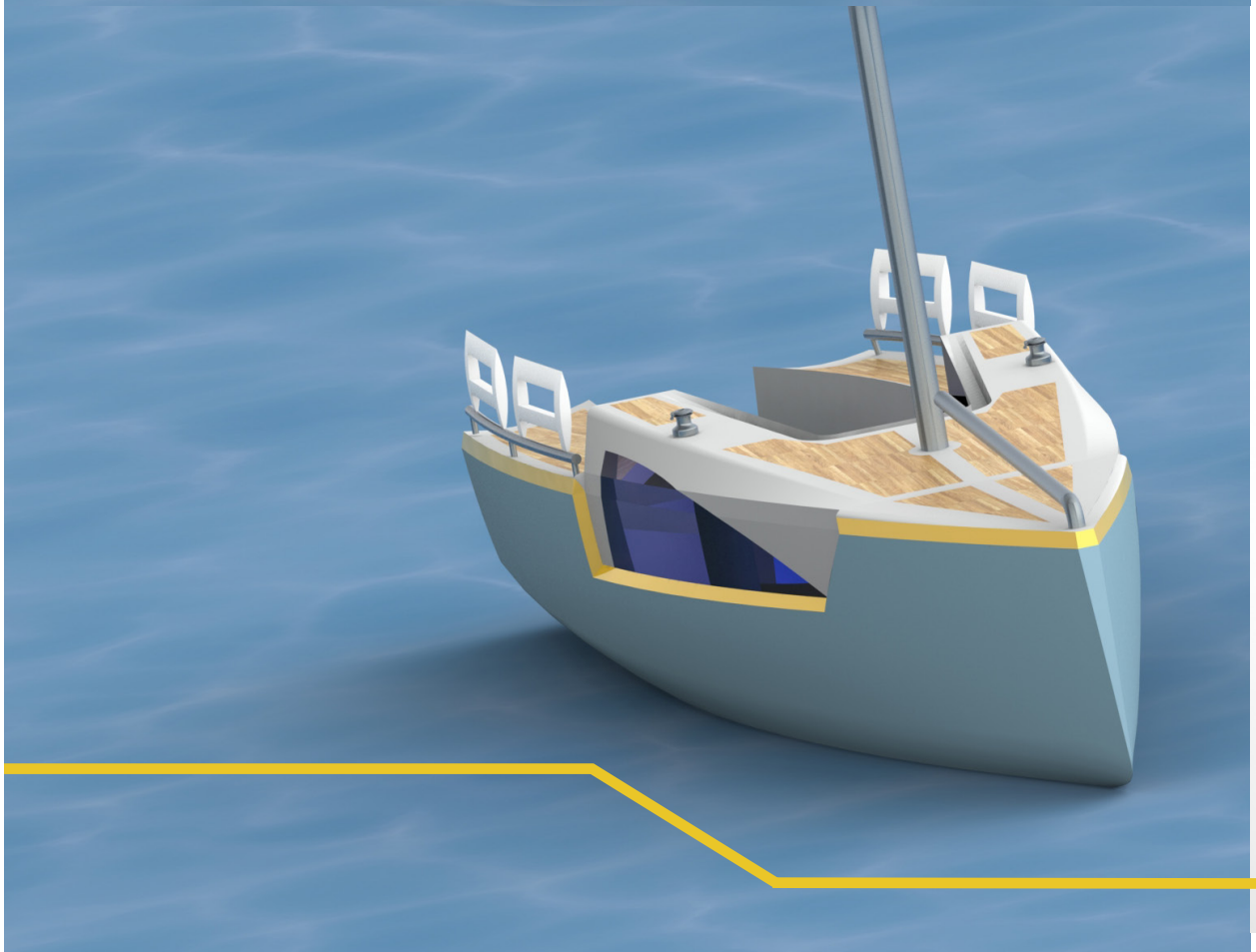
The design is adjusted according to the style collages from chapter 7 and according to the wishes from the target group. This means the design for 50+ gets an inboard diesel motor, alcohol cooking and a closed stern. For appearance the colors and materials are brown and wood detailing. The backrests are opened up and the colors outside are modern yet warm and welcoming. For interior warm colors are used as well red-orange tones and wood panelling.

We are back with John and Elisa. They found the sailing boat of their choice. It is a trailerable boat with a length of 8,30m with a low superstructure so John can easily sail it alone. The sailing capacities of the ship are good because the weight is placed low in the middle of the ship and they opted for the lazy jack so hoisting and lowering the sail is fairly easy. In the exterior fold away backrests are realized. This means John can sail sportive with his son but can also relax outside when moored or for Elisa she can fold up the back rest for her backache.
The boat has a big double bed for the two of them and in the interior there are luxurious arm chairs where John and Elisa can relax in the evenings and read their book. Under the side table a toilet is hidden. In the interior an extra bed can be made on the bench. That is very convenient when they sometimes go sailing with extra people. The ship has enough headroom, you cannot stand up straight in the interior but because of the large opening and the covering sprayhood there is still space where you can stand up straight. The small but complete galley, slides under the cockpit benches, which gives some extra space when they are not using the galley. They opted for the alcohol stove because they want to cook on the go. There is a heater on board and a 12 V connection to charge the phone. Behind the side paneling in the interior, all the control panels are hidden, so they can check all the tank levels and be sure and secure about everything.
They chose a teak deck and a light blue hull. They don't need frills when it has no purpose. They went with regular aluminum rigging, this is enough for them. They chose a diesel inboard motor because of the safety. John and Elisa are very satisfied with their new sailing boat.

Fig. 12.9 Moodboards 50+

Next page: Fig. 12.10 Final design 50+





Wealthy Thirties

The design is adjusted according the style collages from chapter 7 and according the wishes from the target group. This means the design for wealthy thirties gets an inboard electric motor, induction cooking and an open stern. For appearance the colors and materials are grey and yellow/red detailing. The backrests are opened up with a geometric pattern and the colors outside are modern. For interior warmer colors are used such as a brown greyish tone and lightblue and yellow.

We also went back to Tim. He bought the same boat but in a very different configuration.
He opted a good-looking sailing boat to take his family and friends on a trip. It has a sportive appearance but also creates a lounge feeling. He went with a metallic hull and grayish deck covering. His rigging is carbon. He can sail it alone but there is space enough to take 6 friends on a daytrip. For facilities everything is available: a cooling, a toilet and the boat has a 220V connection so Tim can add all kind of devices he wants. There is a complete galley but it is shoved under the cockpit benches so it doesn't take any space in the cabin. He has the newest gadgets to show off; he has a wireless system to play his music and to monitor all kind of the things. The sensors measure speed, depth tank levels distance travelled and so on, he can check all this on his Iphone or tablet.
He went with an inboard electromotor, because of the sound and view. He uses his motor mainly to go in and out the harbor and when there is no sailing wind still wants to impress his friends with a fast silent boat. Tim has a heater and there is a connection to charge his phone. The boat has sleeping accommodation but with pillows the sleaping can become a lounge. When he goes aboard he wants to put his stuff somewhere so that the ship looks nice and clean. The storage compartment can be very easily reached from the side so Tim doesn't have to remove the cushions of the bed to stow away his luggage.

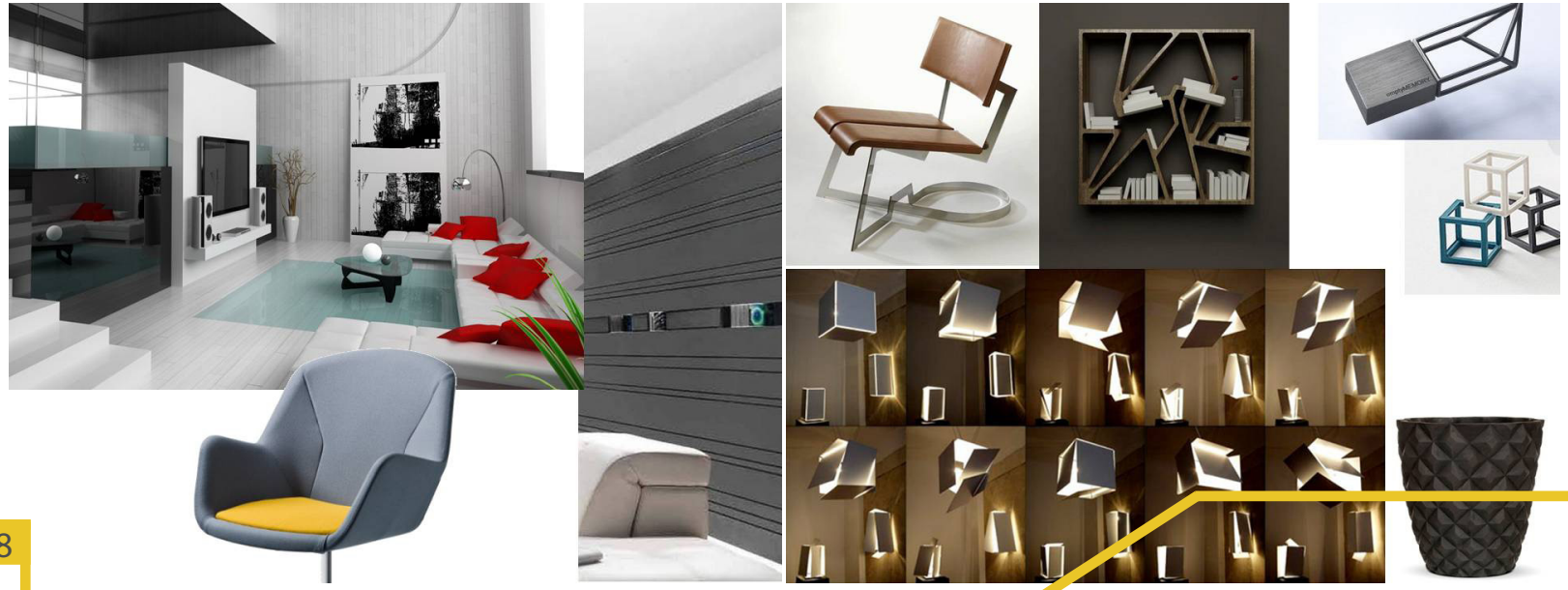
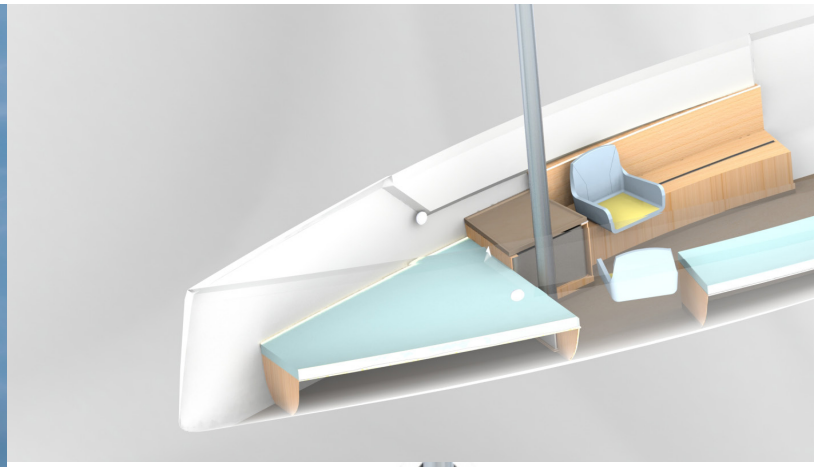
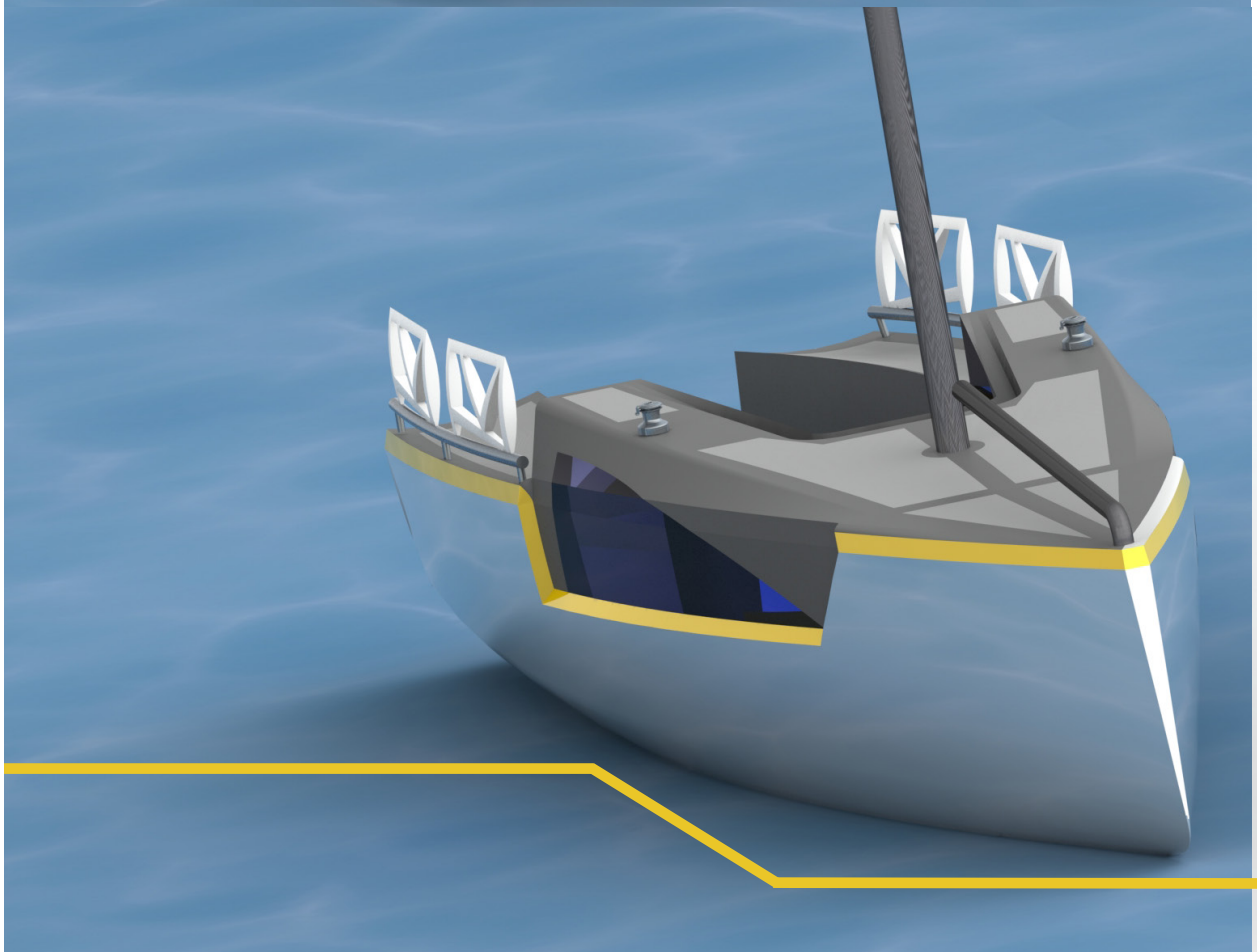
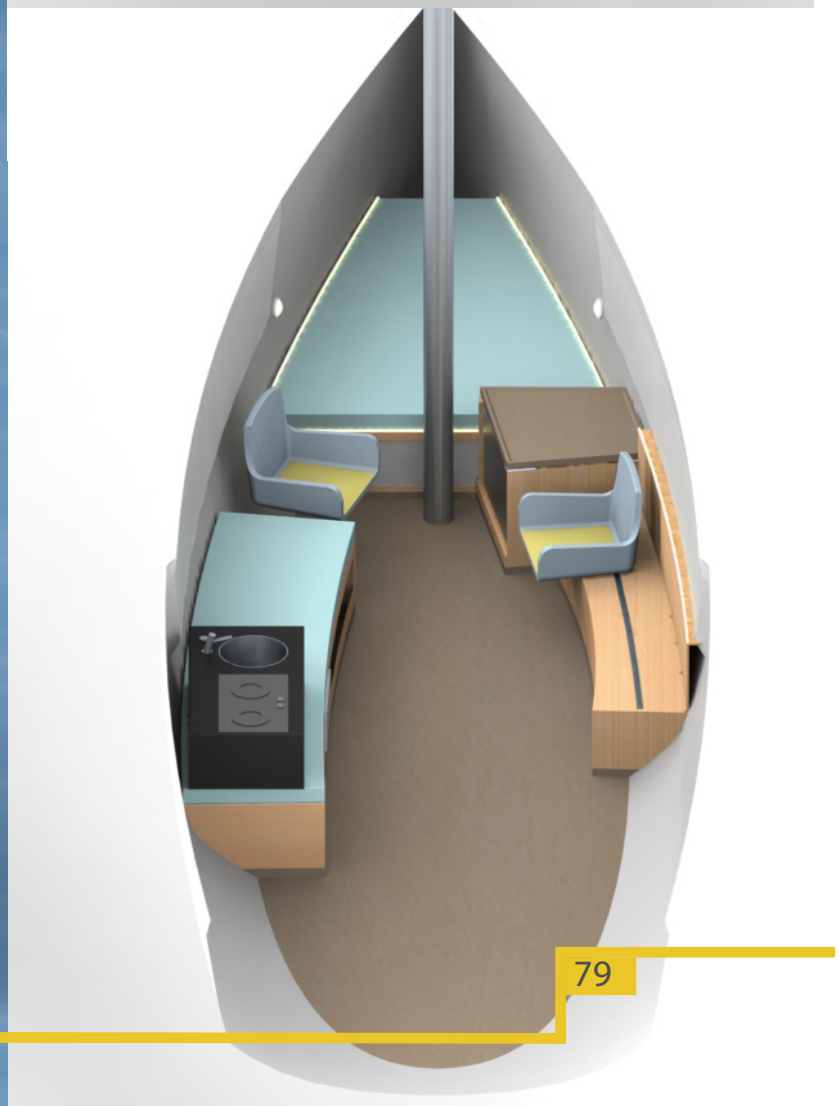


Fig. 12.11 Moodboards wealthy thirties

Next page: Fig. 12.12 Final design wealthy thirties







Rental re-engagement

Here the possibilities to re-engage the rental target group are investigated. The already sought out components for the current target groups can easily be used for the rental group. Materials and appearance need to be adapted, therefore also moodboards for rental were created see fig. 12.13.
For rental these are the points to focus on with the design:

Cleanable
Round and soft
Efficient/basic
White plastic with wood/yellow/orange detailing
Space saving

The configuration will partly be a bit different. There will be an electric motor because of the funding (Provincie Fryslan). The cooking will be alcohol because this is easier and safer and cheaper to replace. There will be heating on board to lengthen the rental season. The cooling drawer and toilet can be removed from the design. Instead of the sliding chair there will be an extra bench with sleeping facility. and there will be no control panels behind the panelling. Also a hard cover for the opening is added because the zipper might be a too fragile part for rentals.

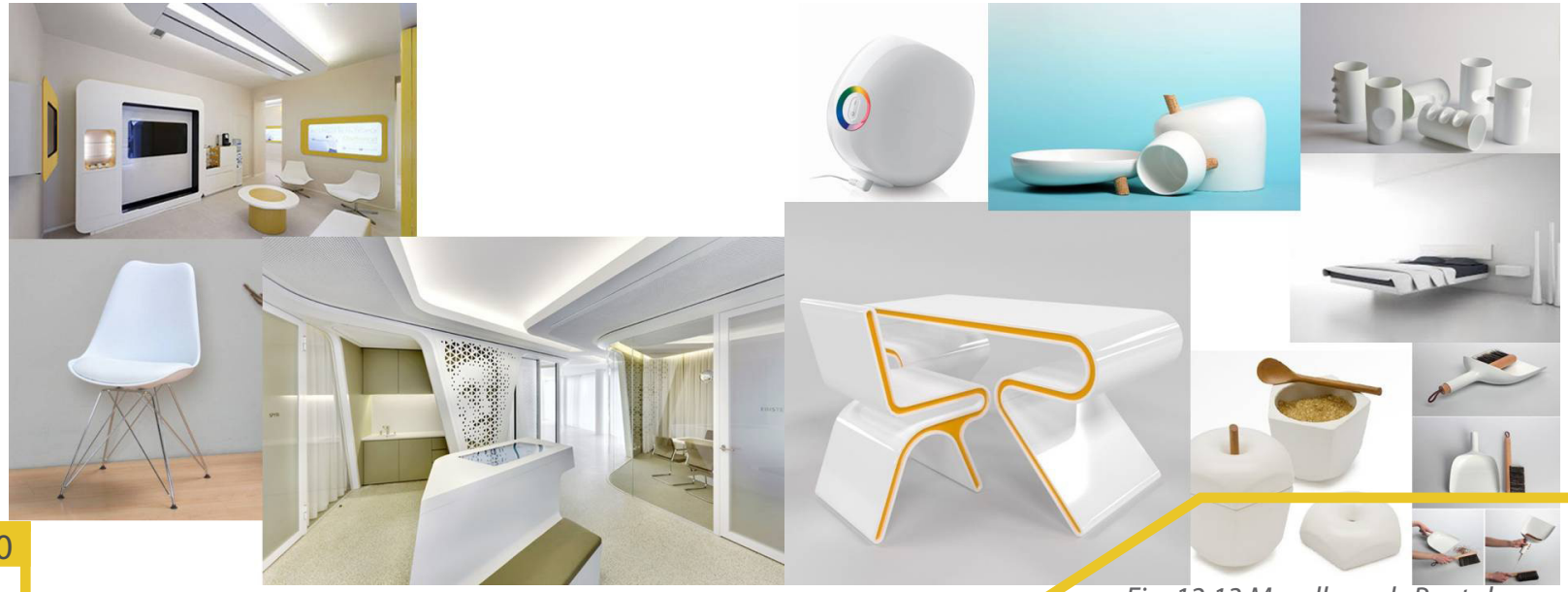
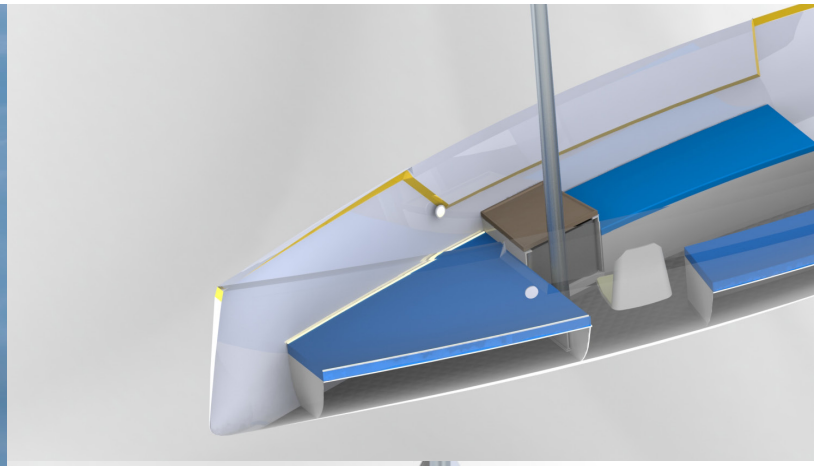
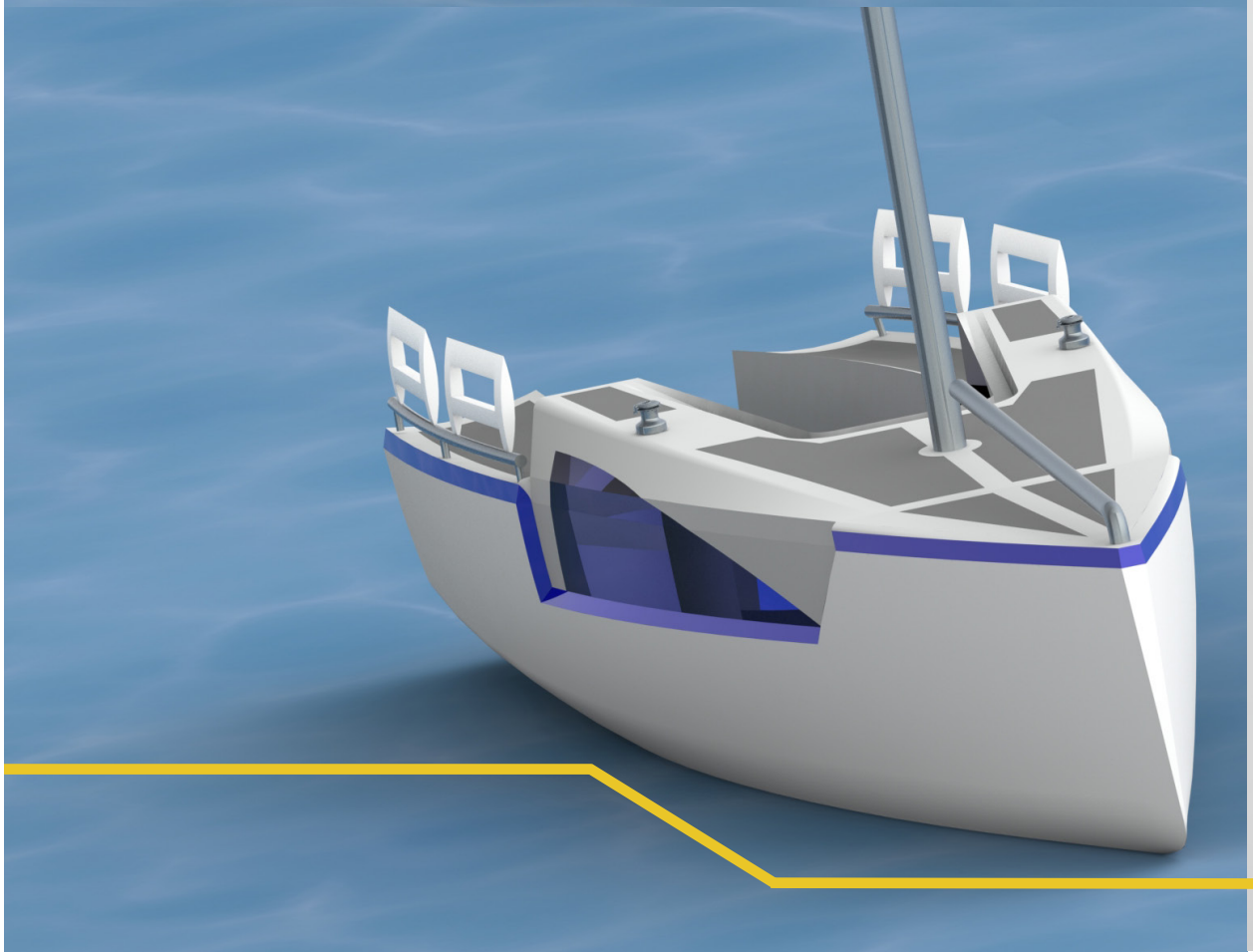


Fig. 12.13 Moodboards Rental

Next page: Fig. 12.14 Final design Rental





13 conclusions and recommendations

The goal of the bachelor assignment was to create a concept design of a yacht, which improves the use of space on board, from the perspective of ergonomics and user experience.
In the previous chapter the design has been tested to the earlier scenarios, the design seemed well suited to the intended target group. It is difficult to ascertain whether the chosen geometry is physically ergonomic. With the sizes in chapter 10 and the sizes of the DINED (DINED) program can be said that the physical ergonomics are reasonable but still could be improved significantly. However, the design had to take into account more factors, such as the appearance and the available space, therefore compromises had to be made on, for example headroom.
The target group wishes to experience the space as being fairly large. When looking from this perspective the use of space is improved by: the comfortable chairs, the hidden toilet, the sliding kitchen inside, the big entrance opening and the fold away backrests outside. The target group values quality over quantity. Therefore most space was used to create a luxurious appearance and feeling instead of using the space as efficient as possible. Therefore the space seems bigger than in the designs currently on the market.
The kitchen can be slid out of sight resulting in a larger-looking space. The toilet is hidden under the side table. When folding the table away it forms a partition between the toilet and the seating area. This partition is not ideal yet. This is a point of improvement of this design. The privacy in toileting should have more attention when this design would be further developed.
The comfortable chairs are surely not a very efficient way of using space but they contribute to the comfortable and luxurious feeling and therefore fit well with both target groups. They provide seating for just 2 people. If replaced with benches, seating for at least 5 people could be realized.
The fold away backrests contribute to the flexibility of the design. When folded down the boat gives a very sportive and open feeling. Folded down, this gives a different perception of space. When folded up they give a lot of comfort and also a secure feeling.
Some of the points in chapter 7 Optical space were used, such as the floor-colored plinth, the light and windows at eye-level. These points attributed to the experience of a larger space in the interior. For the exterior the appearance needed to be different from the current market. With the unusual deckline, the forecastle deck and the foldaway backrests it has a notable appearance.
When reviewing the design brief in chapter 6, it can be seen that most of these points are realized. The big skylight is realized in the big entrance opening, resulting in a big opening is the ceiling as well. Some of the choices for the design on deck, such as a hatch or not in the foredeck, were not yet processed. This could be a next step in the design process.
Recommendations: The exterior appearance can be further elaborated and reviewed by peer- review. All the exterior parts should be designed in detail. All the interior parts need some attention as well and need to be calculated and further developed in detail. The sailing properties and the deck fittings need extra attention since this design didn't focus on these parts of a sailing boat.

Reflection

The start of the project went fairly smooth, the planning was followed and the analyzes were good and had a clear outcome. In the ideation process things were more difficult. It was hard to come up with ideas that were really innovative and followed from the analyzes.

The product appears to be consistent with the analyzes but the company supervisor had different ideas in mind though he agreed on the analyzes. This was a hard thing in communication with the company supervisor, the company wanted something innovative, but the reaction on my work was mostly how he would have done things differently. Since he is an expert in his field I was inclined to follow his instructions. The design of a sailing yacht is a complicated process and therefore multiple times I was lost in which approach I should follow. These things made it hard to be innovative and improving the design.

I did this assignment for a sole proprietor, it gave me a good insight on how it is to be sole proprietor. On the other hand it also led to hearing only one opinion about my work. I think for the process it would have been better to hear multiple professional opinions throughout the process.

The next thing that made it a difficult assignment was that the company and the university have different approaches, standards and goals. Sometimes I would lose sight on these differences. I tried to deliver a good product by following the line of the analyzes. Which eventually led to the product not being interesting enough for the company to continue. The end design should be further tested and developed but the end product meets the requirements and is an innovative design.

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12.8 Rigging from SYD

The rest of the figures are created by the author of this report.

Appendices content

Appendix A plan of approach

Deze bachelor opdracht wordt gedaan in opdracht van Satellite Yacht Design, dit bedrijf ontwerpt zeiljachten voor de consumentenmarkt. Dit bedrijf is een eenmansbedrijf, Kees van de Stadt is gespecialiseerd in het ontwerpen van sportieve zeiljachten. De productie van deze zeiljachten wordt uitbesteed. De speerpunten bij het ontwerpen van de zeiljachten zijn: safety, performance en comfort. Het bedrijf wil bijdragen aan innovaties in het veld en inspelen op de veranderende markt en klantbehoeftes. Het bedrijf wil een concurrentie voordeel behalen.
De ontwerpen van Satellite Yacht Design werden hoofdzakelijk als one-off gebouwd. De laatste jaren voor de Chinese markt is er meer seriebouw. De belangrijkste actor is in dit geval de klant, deze heeft bepaalde eisen en wensen waar rekening mee gehouden moet worden.
De klant moet het product van Satellite Yacht Design verkiezen boven alle andere producten in deze markt. Een andere belangrijke actor is de werf waar de productie van de zeiljachten plaatsvindt. De werf heeft beperkte mogelijkheden voor productie, hiermee moet het bedrijf rekening houden in het ontwerp proces. Een andere actor waarmee rekening moet worden gehouden is de overheid, er zijn talloze regelgevingen op het gebied van jachtontwerp. Er moet zorg gedragen worden dat deze nageleeft worden.
Ook de concurrentie is een actor omdat het bedrijf de concurrentie voor wil zijn. Ook de producenten van onderdelen zijn belangrijk omdat in het ontwerp veel bestaande delen worden gebruikt.
Project kader
De laatste jaren zien we de trend van “glamping” (glamourous camping). Dit is kamperen met een beetje extra luxe. Mensen met een bovengemiddeld inkomen willen dicht bij de natuur zijn maar nog steeds genieten van de voorzieningen die ze gewend zijn. Ook in de wereld van de watersport heeft dit zijn invloed. De afgelopen decennia is de sloep helemaal hip geworden, dit is een comfortabele boot waarmee hard gevaren kan worden en men dichtbij het water zit maar ondertussen wel van alle gemakken is voorzien. Bij het ontwerp van kleine zeiljachten wordt nog weinig met deze trend gedaan. Ontwikkelingen met betrekking tot deze trend zouden tot een grote innovatie kunnen leiden. Daarom wil Satellite Yacht Design een nieuw ontwerp met deze trend in het achterhoofd. De gebruikservaring van het nieuwe zeiljacht zal er een van comfort zijn, zonder iets in te leveren op veiligheid of performance. Dit zou kunnen worden gedaan door de beschikbare ruimte aan boord anders te benutten. Daarnaast wil Satellite Yacht Design door samen te werken met studenten een frisse blik op het ontwerpen van zeiljachten.

Doelstelling:
Praktijkgericht onderzoek -> product ontwerp
Object: zeiljacht
Optiek: ontwerpgericht en aanpassingsgericht
Analyse, ontwerpfase en detailleringsfase

Doelstelling van deze opdracht is het creëren van een conceptontwerp van een zeiljacht, waarbij bij het ontwerpen gekeken wordt naar het gebruik van ruimte aan boord, vanuit de optiek van de ergonomie en de gebruiksbeleving. Dit zal gedaan worden door eerst de huidige gebruikssituatie te analyseren en de gewenste gebruikservaring in kaart te brengen aan de hand van scenario`s, die opgesteld op basis van situatie variabelen. Vervolgens worden ideeën gegenereerd op basis van deze scenario`s. Er zal een ideerichting worden bekeken door een jachtbouwer. Uitgewerkt worden tot volwaardig concept en gepresenteerd worden in een 3D cad model. Dit alles zal in een tijdsbestek van 3

maanden plaatsvinden.

Hieronder worden de hoofd- en deelvragen genoemd:

Wat zijn de eigenschappen van zeiljachten met een soortgelijk doel?

Wat zijn de dimensies van deze zeiljachten?
internet » inhoudsanalyse opdrachtgever » documentatie
Wat is de uitstraling van deze zeiljachten?
internet » inhoudsanalyse werkelijkheid » observatie
Wie gebruiken deze zeiljachten?(doelgroep)
internet » inhoudsanalyse opdrachtgever » documentatie

Welke gebruikssituaties zijn er voor zeiljachten met een soortgelijk doel?

In welke situaties worden zeiljachten gebruikt door de doelgroep?(vorige vraag)
internet » inhoudsanalyse werkelijkheid » observatie ondervraging » interview gebruikers» face-2-face.
Wat zijn de variabelen in deze situaties?
werkelijkheid » observatie
Welke standaard en extreme gebruiksscenario`s kunnen worden gedefinieerd?

Wat is het programma van eisen voor het ontwerp van zeiljachten met een soort gelijk doel? (gebaseerd op voorgaande vragen)

Welke eisen aan het zeiljacht volgen uit de voorgaande analyse?
Welke eisen stelt de producent aan het zeiljacht?
ondervraging » interview producent» face to face.
Welke eisen stellen de opdrachtgever en overheid aan het zeiljacht?
Documentatie » inhoudsanalyse internet» inhoudsanalyse

Wat zijn mogelijke oplossingen voor het ruimte probleem en het verbeteren van de gebruikservaring aan boord?

Welke bestaande oplossingen zijn er voor ruimte gebrek aan boord ?
Documentatie » inhoudsanalyse internet» inhoudsanalyse
Welke mogelijke deeloplossingen zijn er om aan de afzonderlijke eisen te voldoen?
Welke mogelijke deeloplossingen kunnen gegenereerd worden op basis van de scenario`s?
Welke conceptvoorstellen kunnen op basis van de deeloplossing gegenereerd worden?

Welk concept ontwerp voldoet het beste aan de doelstelling?

Welk conceptvoorstel is aanbevolen n.a.v. toetsing op basis van het PvE en de scenario`s?
Welk concept voorstel heeft de voorkeur van de opdrachtgever?
Welk concept wordt aanbevolen uit oogpunt van de ergonomie en ruimte verdeling aan boord?

Wat is het uiteindelijke 3d-cad model?

Appendix B planning

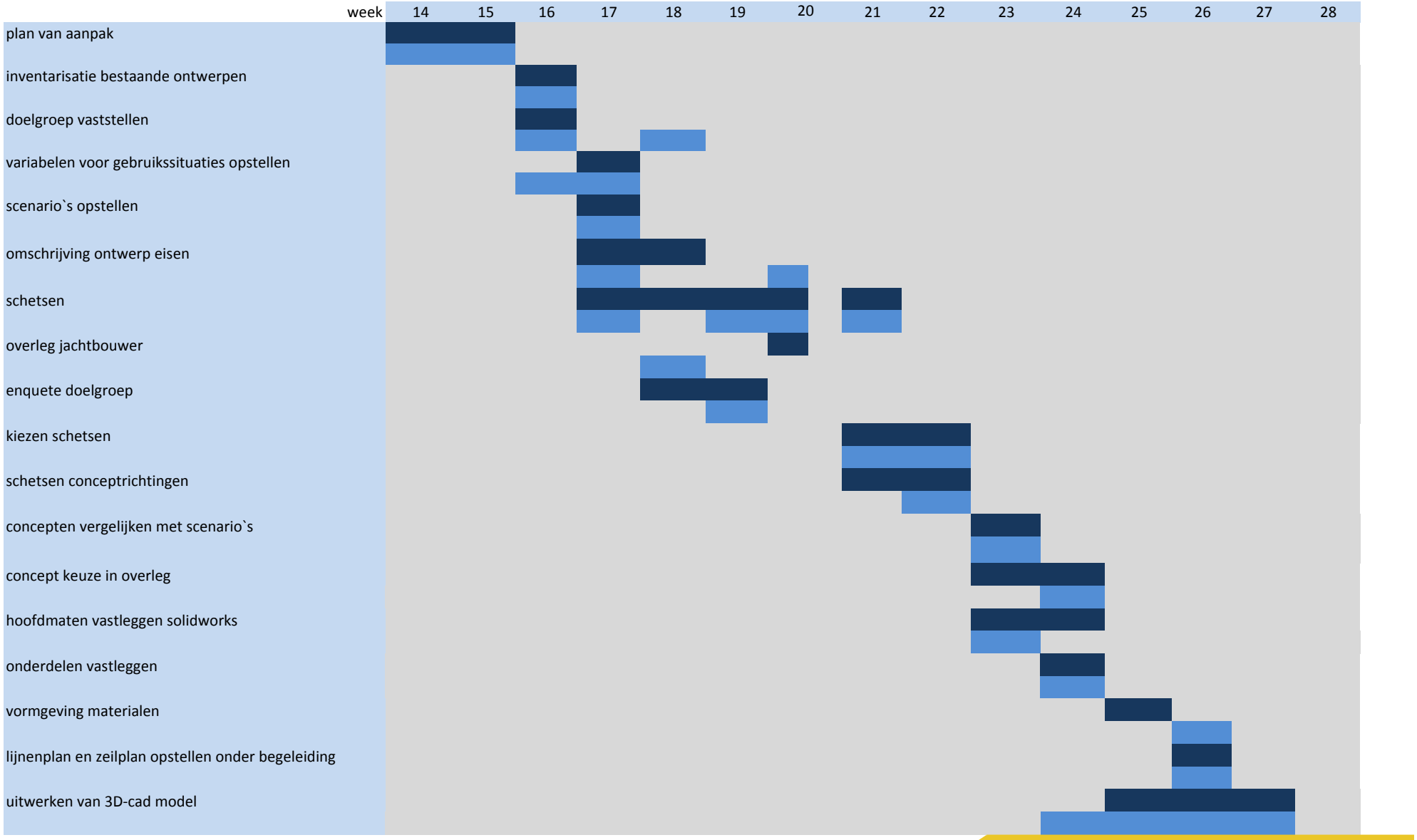

Fig. B.1 planning

Appendix C requirements

The design must be a sailing yacht, in this PVE certain functionalities are captured with respect to the user:

- The ship must have good sailing properties
- The ship must provide comfortable sleeping
- The ship must provide comfortable seating
- The ship must be flexible in use
- The ship must provide cooking facilities for a simple meal
  - *2 hobs*
  - *Water supply*
  - *Workspace*
- The ship must provide a private toilet.
  - *Toilet*
  - *Blackwater tank*
  - *Electric pump system*
  - *Closing for toilet*
- The ship must allow to do dishes .
  - *fresh and waste water tanks*
  - *sink*
- The ship must provide opportunity to recreate the evening (reading, playing cards etc.)
  - *Lighting*
  - *Seat*
  - *Small table*
- The ship must provide the possibility to eat on board.
  - *Seat*
  - *Large table*
- The ship must provide storage for clothes and supplies.
  - *Storage space near the bed*
  - *Storage near kitchen facility*
  - *Storage space for sailing equipement*
  - *Storage for valuables*
- The ship must provide opportunity to be out enjoying the sunshine.
  - *Cockpit Benches length 1,80 m*
  - *Spray Hood to shelter from spray water*
- The ship must offer the possibility of charging phones.
  - *12 volt socket*
- The ship must have a modern, friendly, cozy, secure, exclusive appearance.

Appendix D interview

Jachtwerf Heeg is a versatile company a marina, wharf, winter storage and rental business in one. They build 4 types of boats from scratch. One of these boats has been designed by the director himself, the pointer 25. In addition, they build the Randmeer, G2 and Splash. All from polyester molds. The pointer is the only cabin cruiser they produce. They have all four types in the rental business.

In the design of the pointer the director, Geert has taken the target audience into account. The pointers target groups are young people with children (startersmodel) and older people looking for a little more comfort. The boat is used for touring. The boat should offer more comfort than a Randmeer and be more beautiful than a fox. The design should especially be beautiful and have good sailing capacities. Geert also saw that the elderly often take a step back from their big yacht because of their partner. The yacht has a galley, and a built-in electric motor. During design manufacturing was also emphasized the pointer has a very easy production process. As a result, the price of the yacht is much lower, they produce in series otherwise it is not cost-effective. They first make a plug, which is milled from MDF and then all perfectly finished. From this plug a mold is made.

Geert sees Electric sailing as an option for large water in Friesland it is less interesting because you often travel long distances and Batteries have not progressed far enough to support it. It could be the future, but whether it is as environmentally friendly as suggested, is another question. For your own environment it is fine, because of less noise and less smelly gases. The production of the batteries is a whole other story. An open stern he finds modern but doesn't stroke with children and therefore the design of the pointer has a closed stern. For facilities a toilet was a must for the women. The seats inside are pretty standard. The benches have a folding backrest system thus you sit better and also have the space to sleep well. There is little storage space because of the required openness. there is a cable on which things can be hung.

Rental is an interesting target because of its size. The description of the group of 50+ corresponds well with his vision. The wealthy thirties, he has not chosen as a target because he considers this group quite small. He has so little regard for its price. I choose a slightly wealthier target group, therefore it is small but the yacht has a luxurious look. And more options. We will look at the seating.

Striking I found was the seating on the yacht. It is claimed to be comfortable but in my opinion they were to low and felt therefore more sporty. Design of the interior was quite bare, still boring and straightforward better than the standard rental but still nothing out of the ordinary.

Appendix E questionnaire

Enquête vragen:

1 Bent u een man of een vrouw?

2 In welke leeftijdscategorie valt u?

1 20-30
2 30-40
3 40-50
4 50+

Bezit u een zeilboot? Zoja welk type

Ligt uw boot in een haven met veel voorzieningen?

Geef in de tabel aan hoevaak u de volgende dingen doet aan boord (nooit = 1 tot altijd = 5)

- Zeilen
- Op de motor varen
- Kaartlezen
- Slapen
- Koken
- Koffiezetten
- Toilet gebruiken
- Douchen

Zet op volgorde welke aspecten u belangrijk vind bij het kiezen van een nieuwe boot (hoogst gewaardeerde staat op 1 , laagst gewaardeerde op 7)

- Afmetingen
- Comfort
- Voorzieningen
- Zeileigenschappen
- Milieu
- Vormgeving
- kosten

	57	52	48	42	11	6	2	53	49	46	35	26	23	21	20	14	13
geslacht	v	m	m	m	m	m	m	v	m	m	m	m	m	m	m	m	m
leeftijd	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
booteigenaar	delanta 80	van de stadt pionier 10	nash 20	j22	efsix	31 ft	nee	beneteau first	seamaster 925	j24	efsix	koopmans 34	one off 22	nee	friendship 23	oceaan22	efsix
jachthaven	ja	nee	nee	ja	nee	ja	nee	ja	ja	trailer	trailer	nee	trailer	ja	nee	ja	nee
zeilen	5	4	4	5	5	5	5	5	4	5	5	5	5	4	4	4	5
motor varen	2	2	3	1	1	3	2	2	2	5	2	4	4	3	3	2	2
kaart lezen	1	3	2	2	2	4	4	3	3	2	3	4	4	3	3	2	1
slapen	3	3	2	1	1	4	4	4	4	2	1	4	3	4	2	3	1
koken	3	4	2	1	1	2	3	4	4	2	1	4	3	4	3	2	1
koffiezetten	1	2	1	1	1	5	4	5	4	1	2	1	5	3	3	3	1
toilet	5	4	1	1	1	3	2	5	3	2	1	4	1	3	3	1	1
douchen	1	2	1	1	1	1	1	2	1	1	1	2	1	2	1	1	1
afmetingen	1	2	1	2	3	3	3	3	3	5	3	7	7	1	5	1	4
comfort	2	4	4	5	4	6	1	2	4	2	5	5	4	4	3	3	5
voorzieningen	3	6	5	6	7	4	5	4	5	6	4	2	5	3	4	4	6
zeileigenschappen	4	1	2	1	1	1	2	1	2	1	2	4	1	5	2	2	1
milieu	7	7	6	7	6	5	7	7	7	7	7	6	6	7	7	7	7
vormgeving	5	5	7	3	2	2	6	5	1	4	6	1	3	6	6	5	2
kosten	6	3	3	4	5	7	4	6	6	3	1	3	2	2	1	6	3

	8	54	51	50	47	45	43	39	38	37	36	27	19	17	16	9	4
geslacht	m	m	m	m	m	m	m	m	v	m	m	m	m	v	m	m	m
leeftijd	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
booteige-naar	dehler op-tima 106	bene-teau first 30	wes-terly page-ant	trident 80	etap 22	dainio 720	feeling 286	de vries lent-sch	one off	lana-verre l17	dufour 29	spirit 28	nee	friendship 28	dufour 1800	kajuit-zeil-boot	lm 27
jachthaven	ja	ja	nee	ja	nee	ja	ja	ja	ja	nee	ja	ja	nee	ja	ja	ja	ja
zeilen	3	5	3	5	4	5	4	3	4	5	3	5	4	4	5	4	4
motor varen	3	3	4	2	3	5	4	3	5	2	4	5	1	3	2	2	2
kaart lezen	2	2	2	3	2	2	3	3	4	3	3	5	2	2	4	3	3
slapen	5	3	2	2	3	2	4	3	5	3	5	3	2	3	3	3	3
koken	4	2	2	1	3	2	3	3	4	3	4	3	2	5	3	2	3
koffiezetten	2	1	2	3	4	3	3	4	5	3	5	3	1	5	4	3	5
toilet	5	3	3	2	2	5	3	2	5	3	5	4	1	5	4	3	3
douchen	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
afmetingen	3	3	2	1	1	7	1	1	6	2	1	1	1	1	1	3	3
comfort	4	2	5	5	6	2	3	5	3	3	2	5	5	4	4	2	2
voorzienin-gen	5	5	3	7	3	1	4	4	4	4	4	3	6	2	5	5	1
zeileigen-schappen	2	1	4	3	2	5	5	2	2	1	5	6	2	3	3	4	5
milieu	7	7	7	6	7	6	7	7	7	5	7	7	7	7	7	7	6
vormgeving	6	4	6	4	5	4	2	6	5	7	6	4	4	6	6	1	7
kosten	1	6	1	2	4	3	6	3	1	6	3	2	3	5	2	6	4

	55	44	41	34	32	31	30	28	25	18	15	12	7	5	3	1
geslacht	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	v
leeftijd	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
booteige-naar	cle-ver23	waar-schip 870	elan 350	bavaria 32	9m kajuit-jacht	wind-rose 22	avance 24	phan-tom 35	lm27	stand-fast loper	nee	dehler optima 92	spirit 28	nee	winner 950	clever 23
jachthaven	nee	ja	nee	ja	ja	ja	nee	ja	nee	ja	nee	ja	ja	ja	nee	nee
zeilen	4	3	5	4	4	5	3	4	2	5	5	5	5	4	4	4
motor varen	2	2	2	3	3	3	3	3	4	2	2	3	3	2	2	2
kaart lezen	2	2	5	4	5	2	2	3	5	3	4	4	4	4	3	2
slapen	3	3	5	4	3	2	2	3	4	3	4	5	2	4	4	2
koken	2	2	5	3	3	1	1	3	4	2	4	5	2	4	2	1
koffiezetten	3	3	5	4	4	2	2	3	5	3	5	5	3	4	4	4
toilet	2	3	3	3	5	1	2	3	5	3	4	5	2	2	3	2
douchen	1	1	2	2	2	1	1	1	1	1	2	1	1	1	1	1
afmetingen	1	2	4	1	1	5	1	3	1	1	2	2	3	1	1	1
comfort	2	5	3	4	4	2	4	2	2	4	4	5	4	2	2	3
voorzienin-gen	6	6	5	5	3	6	6	5	3	5	1	3	6	4	6	6
zeileigen-schappen	3	3	1	3	2	1	3	4	6	3	3	4	1	3	3	4
milieu	7	7	6	7	6	4	7	6	7	6	7	7	7	5	5	7
vormgeving	5	4	2	2	5	7	5	7	4	7	5	6	5	6	4	5
kosten	4	1	7	6	7	3	2	1	5	2	6	1	2	7	7	2

	56	40	33	29	24	22	10
geslacht	m	m	m	m	m	m	m
leeftijd	5	5	5	5	5	5	5
booteigenaar	puma 23	zeewaardig kajuitjacht	olympiajol	multihull	dufour 36	beneteau 24	sneekermeer 800
jachthaven	ja	ja	nee	nee	ja	ja	ja
zeilen	3	5	5	5	5	2	4
motor varen	3	2	1	2	3	2	4
kaart lezen	3	4	1	3	5	2	3
slapen	2	4	1	4	2	2	3
koken	2	4	1	4	2	2	4
koffiezetten	4	4	1	5	4	2	3
toilet	3	3	1	5	4	2	2
douchen	1	1	1	5	2	1	1
afmetingen	2	4	2	2	5	1	1
comfort	1	5	3	5	2	4	3
voorzieningen	4	6	6	6	1	3	4
zeileigen-schappen	3	1	1	1	3	5	5
milieu	7	3	7	7	7	7	7
vormgeving	5	2	5	4	4	6	6
kosten	6	7	4	3	6	2	2

Appendix F competition analysis

Fox 22 (fox22)

Length over all(meters):	6,60
Draft:	1,25
Hull material:	Polyester
CE design category:	C
Number of beds:	4
Sail area	23,5

Positive: interior space, forecastle deck, robust, sailing performance
Negative: appearance, comfort

Fig. F.1 fox 22

Elan 210 (elan210)

Length over all(meters):	6,34
Draft:	0,50 – 1,55
Hull material:	Polyester
CE design category:	C
Number of beds:	4
Sail area	28,3 m

Positive: sportive sailing, good space solutions
Negative: outboard motor, messy look inside

Fig. F.2 Elan 210

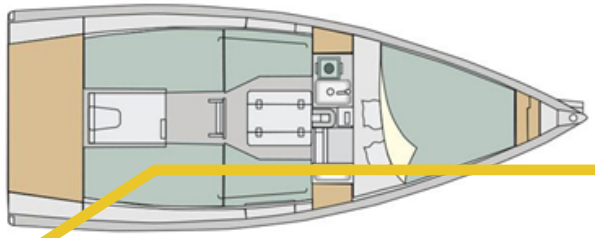

Fig. F.3 Elan 210 top view

Beneteau First 25(beneteau)

Length over all(meters):	7,90
Draft:	0,85 – 1,85
Hull material:	Polyester
CE design category:	B
Number of beds:	4
Sail area	33,3

Positive: high backrest, built-in motor, separate toilet
Negative: small cockpit, classical interior design, many partitions inside

Fig. F.4 Beneteau first 25

Waarschip daysailer(waarschip)

Length over all(meters):	6,70
Draft:	0,70 – 1,20
Hull material:	Polyester
CE design category:	B/C
Number of beds:	4
Sail area	32,4

Positive: modern new design, sailing characteristics
Negative: designed for sports, no facilities on board, uncomfortable

Fig. F.5 Waarschip

Winner 8(winner)

Length over all(meters):	8,00
Draft:	1,50
Hull material:	Polyester
CE design category:	B
Number of beds:	5
Sail area	42

Positive: all facilities available, good seating, extra double bed
Negative: interior design, small cockpit, open stern spoiled by railing

Fig. F.6 Winner 800

Sportina 680(sportina)

Length over all(meters):	6,80
Draft:	0,30 – 1,40
Hull material:	Polyester
CE design category:	B
Number of beds:	5
Sail area	23

Positive: low cabin, asymmetrical interior design
Negative: small cabin entrance, outboard motor

Fig. F.7 sportina 680

Pointer 25(pointer)

Length over all(meters):	7,60
Draft:	1,10
Hull material:	Polyester
CE design category:	B
Number of beds:	4
Sail area	25

Positive: closed stern, thought of toilet private, thought of production, inboard motor
Negative: plastic design.

Fig. F.8 Pointer 25

Etap 22(etap)

Length over all(meters):	6,60
Draft:	1,25
Hull material:	Polyester
CE design category:	-
Number of beds:	4
Sail area	29,4

Positive: buoyancy, safety, stability,
Negative: old fashioned, little facilities.

Fig. F.9 Etap 22

Appendix G electric cooking

If the cooker is using all burners the power is: 3600 W
If you use the stove for about 30 minutes at full power you come at 1800 Wh.
Shared by the voltage of the battery: 12 = 1800/12 = 150 Ah
Because the battery cannot be fully discharged and because of efficiency:
150/40 * 100/80 * 100 = 468 Ah needed.

Because the load on the battery must be only 1/5 of the capacity we need batteries with a capacity of about 2500 Ah.
In electric or hybrid car is Batteries are:
100kWh = 8333 Ah at 12 V
4166 Ah at 24 volts
833 Ah at 120 volts
454 Ah at 220 volts
The cooking devices usually operate at 120 or 220 volts
So even with a heavy battery of a car, it is not enough to cook on board in while staying in the safe using range of the Batteries
Is deep cycle batteries an option?
Then discharge is up to 70%.
150/70 * 100/80 * 100 = 268 Ah needed.
Total 268 * 5 = 1400 Ah battery required. is still to much. so cooking a full meal on a battery isn`t an option.

But what if you just want to warm up something on the go? Use one burner: for about 10 minutes. one small burner is 1200W
1200 * 1/6 = 200 Wh
200/12 = 16.66 Ah

16.66 / 40 * 100/80 * 100 = 52 Ah
About 250 Ah is needed which is realistically achievable, but there will be more consumers in the ship it is a choice to take the whole battery capacity for shortly warming up, or for all the other facilities.

Appendix H optical space

A dark Floor and light walls give a wider look

A dark floor and dark ceiling, make the space wider and lower

Dark walls with light ceiling and floor emphasize horizontal lines

Light floorceiling and backwall, the space narrows and is deeper and higher

A dark backwall shortens the room

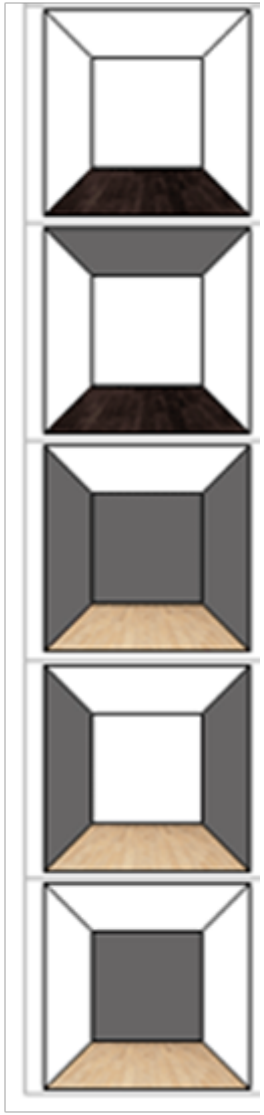

Fig. H.1 optical space

A light ceiling, dark Floor and dark walls give a cellar effect

A light floor, light backwall, dark walls and dark ceiling, give a tunnel effect

All the surfaces have the same color it seems shapeless

A lot of light colors give a spacious feeling, but can be to cool or impersonal

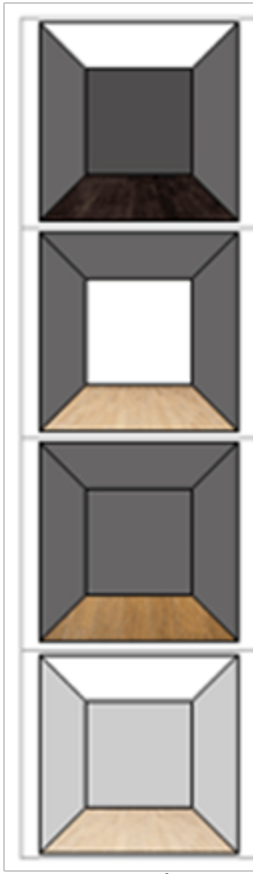

Fig. H.2 optical space

Appendix I parts

Galley:
The galley is a sliding unit where cooking and water is facilitated.
Electric cooking(dometic)
Electric cooking you can only use when moored because of shore power, batteries cannot be large enough to create enough power for the cooking.(appendix electric cooking)
For electric cooking the Dometic inductionPI7602, 2300W 2 hobs 5,3 Kg was chosen it has a clean design and touchscreen buttons.
Sink with tap and pump
A round sink is opted a small faucet behind it, controlled by a switch connected to the pump.

A round sink diameter:300 mm depth 145 mm was chosen.
And a small water pressure pump 12V, Propumps FL2202A, 2,4 A, 80 psi is placed(topbuy).
In the galley these components are combined the galley measures: 900*400*350 mm. It hangs on slider rails on both sides and slides under the cockpit benches.(gsf-slides)
These slider rails can take up to 300 Kg and slide out to a length of 900 mm. The total weight of the galley component is just : 40 Kg(added up all components and a filled sink). But the slider rails have to keep up when somebody falls or leans on to the galley unit, therefore a support weight of 90Kg wasn't sufficient, so the stronger version was opted.
 The galley block contains an electric stove and a sink. Therefore the kitchen needs water supply and drain and electricity supply. These supply and drain need to be flexible since the kitchen can move. The electricity goes through a cable to the energy station to the wall connection which is placed in the cockpit. The water supply and drain go to the right tank the pipes are flexible hoses. In the kitchen block there is a pump for the faucet. Which is also connected to the electricity station since this one works on different voltage than the stove, it is another connection. The material chosen for the galley is wood composite with a sticker bleached wood.

Fig. I.1 round sink

Fig. I.2 propump FL2202A

Fig. I.3 slider rails

Fig. I.4 dometic induction

Toilet (cleghorn-1) (cleghorn-2)
The toilet chosen is the smallest design available, the Jabsco compact bowl electric, 12V 16A 351*352*496 mm. It uses 1-2L per flush.
It is connected to the freshwater tank and to the waste water tank the pump is also connected to the 12V electricity network.

Fig. I.5 Jabsco compact

Watertanks (vetus)
The tanks have different openings and connections: the freshwater tank has a filling opening and a connection to the freshwater system on board. both tanks are 60L vetus quickfit tanks
The holding tank is connected to the waste water system, when full it has to be emptied in a harbor through a deck fitting or through a through-hull discharge, which is made for sailing on large open waters where you are allowed to discharge. The tanks also need a vent, for the built up pressures.

Fig. I.6 wastewatertank

Fig. I.7 freshwatertank

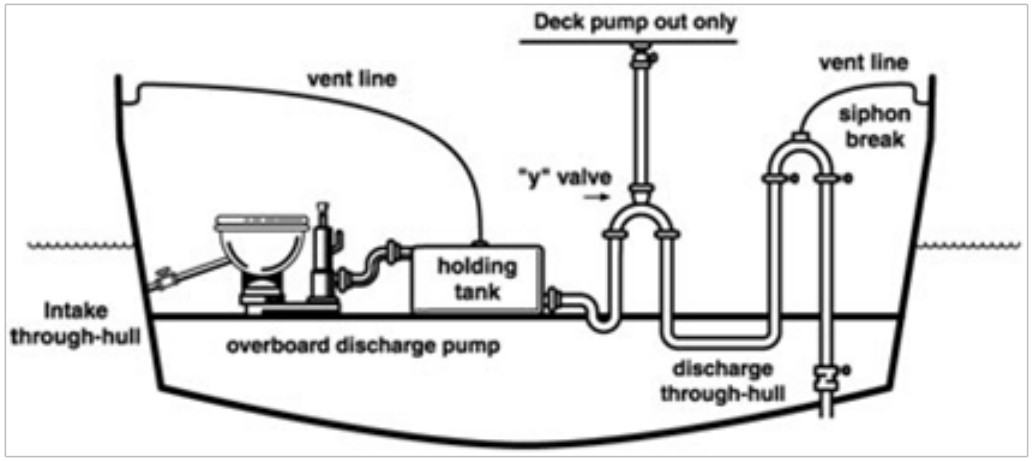

Fig. I.8 waste watersystem

Cooling(wagenaar):
For cooling an electric cooling drawer was chosen the Weaco 20L it works on 12V 40Watt and weights ca. 16,0 kg. The compressor unit can be mounted apart from the cooling max 50 cm. and will be mounted underneath the drawer.
The cooling is placed in the bench close to the opening and galley because then it is close by when cooking and also close to outside to grab a cold drink.

Fig. I.10 Weaco cooling drawer

Placing a heater when having an electric motor, takes a bit more difficulty. Normal marine heaters work on diesel, when having no diesel tank onboard it would be necessary to install one just for the heating. This is an easy operation and a better option than using a electric powered heater, because the heater would then only work when moored (because of the great amount of power needed).

Motor:
for the target group wealthy thirties an electric sail drive motor is opted. An offer was made by a company specialized in electric motors, "De Stille Boot" they advise the: Saildrive Krautler SDK 4,3 AC - 48V - 5 KW weight: 45 Kg.
We need 4 to 5 sailing hours on one battery pack. There are four options given, three with different sized AGM batteries and one with Li-ionbatteries. the li-ion batteries weigh: 55Kg but these are more expensive and give a slightly lower power. These batteries would enable sailing for 3,4 hours, which is not enough. The biggest battery pack(AGM)is opted, this is 4 batteries 12V and 260 Ah, it would enable sailing 5 hours. This should be sufficient. This battery option is very heavy: 312 Kg. The weight has to be placed low in the centre of the hull for better balance (appendix offer de stille boot). When weight becomes a big issue, there can still be an option for the li-ion batteries but maybe add more batterypacks.

Fig. I.9 Saildrive krautler

Heater(webasto):
For a diesel heater the Webasto Airtop evo 3900 is chosen
This system requires an air inlet and several air outlets. Also diesel should be fueled to the system.
Also a control panel is placed. Here the heating can be turned up. The panel is placed inside behind the paneling.

Fig. I.11 Webasto airtop

50 + adjusted parts

Galley: Alcohol cooking(dometic-2)

When looking at the scenario you see the electric cooking is no option for this target group. They will use the cooking mainly for heating soup or coffee on the go which is not possible with electric cooking, alcohol is the safest alternative, and safety is important for 50+. The alcohol stove is a stand-alone part. Special alcohol can be bought and put directly into the hobs.

The dometic origo A200 is opted. It has 2hobs and can contain 1,2L alcohol per hob. Both cookers are about the same size, and are therefore easily changeable.

Motor:(volvo)

for this target group safety and reliability are important issues therefore the motor is a diesel motor. The Volvo Penta sail drive D1-13 power: 8,6 kW 11,8 hp is opted.

Because this is a diesel motor a diesel tank is needed. Also a diesel motor needs a stand-alone 12V battery for starting.

For diesel the 60L Vetus diesel tank is opted. For diesel there is an out and inlet and of course a vent.(vetus)

The Vetus tanks are quick-fit.all the tanks (freshwater, waste-water and diesel) get level sensors. And the boat gets a display to show all the tank levels.

Fig. I.12 dometic origoA200

Fig. I.13 Vetus dieseltank

Fig. I.14 Volvo penta saildrive

Fig. I.15 tank level display

Appendix J electricity

For all the electric facilities it is calculated how many and big batteries are needed.
Cooling: 12 h, 40 W, 12V = 40 Ah(dometic)
Waterpump: 1 h on 2,4 A =2,4 Ah (alibaba)
Toilet: 16 A for 0,5 h= 8 Ah (jabsco)
Lighting:
Led strips: 5 W/m 15 m = 75 W voor 6h 12V = 6*75/12 = 37,5 Ah(led-stripkoning)
Bed and reading light: 4* 3 W = 12W for 6h 12V = 12*6/12= 6 Ah (led-lamp)
Kitchenlight: 1* 5W = 5W 12V for 4h = 5*4/12= 1,6 Ah(ledlamp)
Navigation lights: 4 * 0,54 W = 2,16 W for 12 h, 12V= 2,16 Ah (lank-horst-tasselaar)
Celphone charging: 2,100 Ah is about one celphone battery (pcworld)
Total: 40 + 2,4 + 8+ 37,5+6+1,6+2,16+4,2 = 102 Ah
102/40 *100/80*100= 318 Ah battery is needed. 40 Percent for battery drainage you never actually empty a battery because it is very bad for the lifespan. 80 Percent for efficiency some electricity gets lost to heat.
Opted are 2*175 Ah batteries.
The batteries for propulsion go in a packaged deal with the motor.

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