

SKODA AUDIA

THE FUTURE FOR MOBILE AUDIOLOGY



FAST

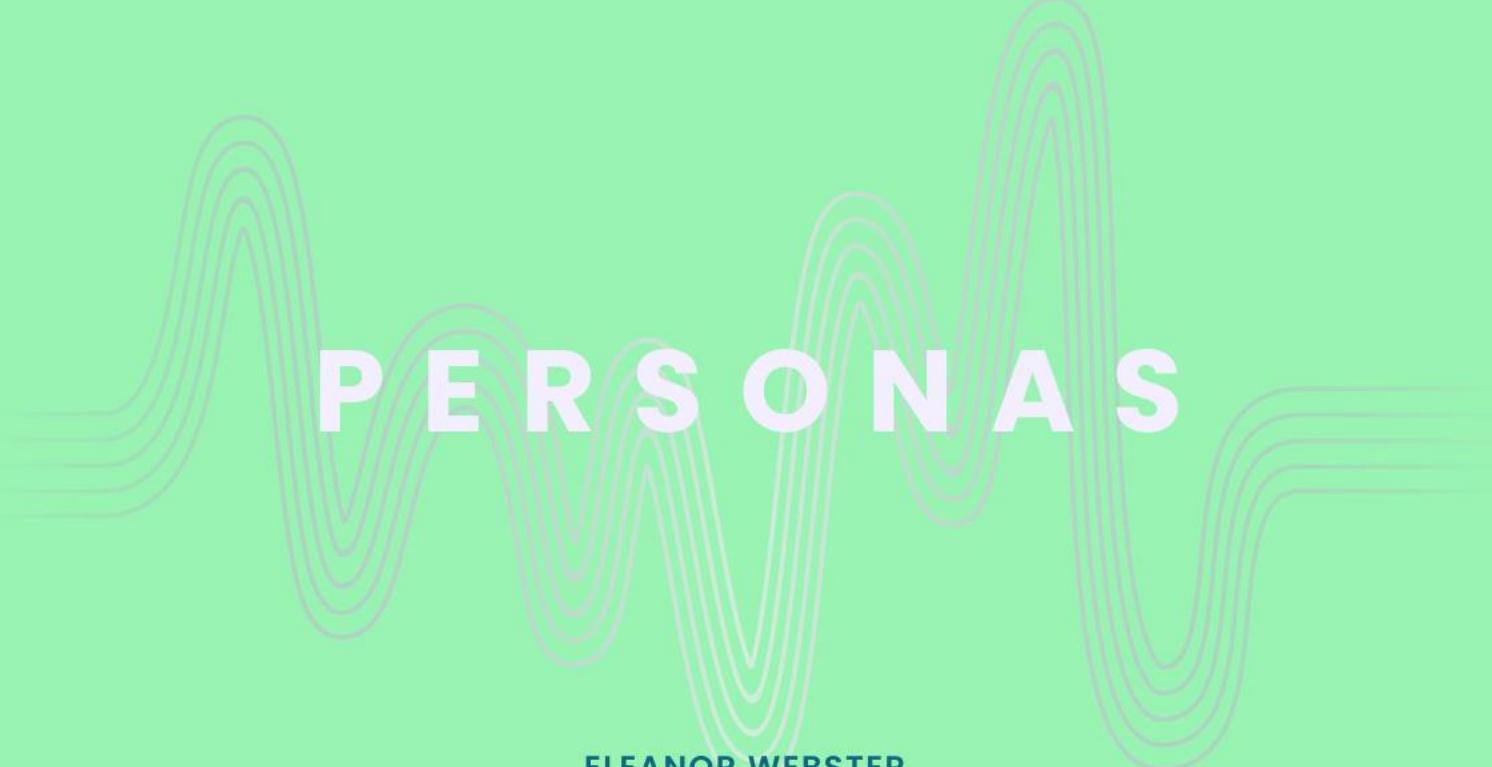


LIGHT



VERSATILE





PERSONAS

ELEANOR WEBSTER

MOHAMMED MUSA

DOMINIC BROWN

JIASHU HUANG

QICHENG LIU

LILY BUTLER

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PERSONAS

USER PROFILE

HUGO PETERS

"I just want to look after myself and my family well. This product could help me do that!"



Gender	:	Male
Age	:	43
Education	:	Master's Degree
Occupation	:	Construction Site Manager
Income	:	£47,500
Status	:	Married with a 18 month old daughter

BIOGRAPHY

Hugh is a confident, young professional who loves taking care of his daughter on his one day off a week. He married young and has loved doing up their large house in the rural outskirts of Stoke-on-Trent. He studied mechanical engineering to masters level and enjoys doing DIY using his skills. His garage is renovated into a workshop. He tries to help out as much as possible with his daughter on his days off to take some of the strain off of his wife who quit her job to be a stay at home mum.

GOALS

- Hugh wants his daughter, Ava's hearing to be normal.
- Hopes his hearing hasn't been affected badly by his job.
- Be given any treatments there and then.
- The clinic to be as close as possible to his home.

FRUSTRATIONS

- Only one day off a week so needs to be quick and simple.
- His daughter struggles with long car journeys.
- He misses things his wife says, affecting their marriage.
- He loves their home but struggles with it being so rural.

TECHNOLOGY

Software

Social Media

Mobile App

MOTIVATION FOR GETTING TESTED

Hugh needs to take Ava for a scheduled hearing test/ check-up Due to his work, he believes he may have some hearing loss. He did some research and it supported his suspicions:

- Approximately 14% of all Construction workers have hearing difficulty.
- About 7% of all Construction workers have tinnitus.
- About 25% of noise-exposed tested Construction workers have a material hearing impairment.

He wants to keep his hearing good for the sake of his family

USER PROFILE

OLIVER WILSON

"Games are amazing. They offer you experiences you cannot experience in normal life, and helps you learn more"



Gender : Male
Age : 12
Education : Middle school
Occupation : Student
Income : £0
Status : Single

BIOGRAPHY

Oliver was born in a happy family. He is positive and always happy to learn new knowledge. He has many friends in school. After school, he loves playing video games with his friends and listening to music. Oliver understands games as an approach to gain valuable experiences and learn more. He uses headphones a lot, especially when staying at home, sometimes in high volume. His parents often take him on a weekend trip and he really enjoys it.

GOALS

- Gain some knowledge on hearing ability
- Do not affect his entertainment
- Test time can be shorter
- Take test in a comfortable environment

FRUSTRATIONS

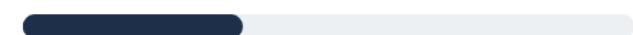
- Do not have knowledge on hearing
- He thinks hearing test is boring and time-consuming
- Test environment makes him uncomfortable
- He thinks regular test is unnecessary

TECHNOLOGY

Software



Social Media



Mobile App



MOTIVATION FOR GETTING TEST

While Oliver's parents are supportive for his hobbies, they are concerned about his health condition, especially hearing. Therefore, they take him to hearing test regularly, while Oliver doesn't think his hearing will be affected by headphones at his young age. Moreover, staying confined spaces in hearing test makes him uncomfortable.

USER PROFILE

JOHN RIVERS

"I wish to spend time with my grandchildren, and hear all of their stories."



Gender	:	Male
Age	:	72
Education	:	MSc in Physics
Occupation	:	Retired Process Engineer
Income	:	£37,620 (Pension)
Status	:	Married (3 Children) (4 Grandchildren)

BIOGRAPHY

Mr. John Rivers is a retired physician who has published marvellous work in the realm of physics and engineering. He spent a majority of his career working in aircraft propulsions for Rolls Royce, and later on worked in Jaguar Land Rover as a Senior Manufacturing Engineer. Alas, his golden career has come to an end at the age of 64, due to hearing and mobility issues. Although far from the city, he now lives happily in a humble town with his wife near Guildford, Surrey.

GOALS

- Have accessible medical care due to isolated living
- Have assistive care for his mobility issue
- Be able to cure his left ear hearing problems.

FRUSTRATIONS

- Difficulty hearing
- Standing for a long while can be stressful

TECHNOLOGY

Software



Social Media



Devices



MOTIVATION FOR GETTING TEST

After a long career, Mr. Rivers wishes to retire with his wife and grandchildren in a comfortable town, away from the city and medical institutes. He looks forward to hearing their stories, communicating with them, and being the best grandfather ever. Due to unknown reasons, his hearing capabilities have depreciated, which in turn made his life more complex.

Mr. Rivers is excited to welcome a transportable medical unit that could reach the town he's in and provide all necessary hearing aid solutions.

USER PROFILE

EMILY BLIGHT

"A healthy lifestyle is really important to me and I won't let my disability get in the way of that"



Gender	:	Female
Age	:	32
Education	:	Bachelors Degree
Occupation	:	N/A
Income	:	N/A
Status	:	Married

BIOGRAPHY

Emily is a proud mother to two who planned on being a stay at home mum until her daughters were both at school. However, about a year ago she was involved in a car accident where she suffered an injury to her spinal cord. This resulted in her having to use a wheelchair, as she has paralysis involving her legs and lower body. Living in the countryside, she has had to make quite a few adjustments to her home and lifestyle, which her friends and family have supported her through. Being active and leading a healthy lifestyle is important to Emily and with her new disability she is determined to stay in the best health in all other ways that she can.

GOALS

- Gauge an idea about her current hearing ability
- Get advice on preventing hearing loss
- Easily complete the test in her wheelchair
- Have an efficient experience

FRUSTRATIONS

- When she can't access places in her wheelchair
- Struggling to hear her children
- Taking longer to move closer to someone to hear them
- Feeling the effects of aging and deteriorating health

TECHNOLOGY

Software

Social Media

Mobile App

MOTIVATION FOR GETTING TESTED

She knows that 50% of stay at home mums feel anxious and 41% routinely worry. She doesn't want to be a part of these statistics, so looking after her health however she can is a priority for her.

She's keen to do it in the EAV rather than use public transport. In a government survey it was found that on average disabled people made 48% fewer commuting trips in 2020 than non-disabled people. With only 37% of disabled respondents agreeing that public transport was very easy to use.

Since she's still getting used to her wheelchair, it takes her longer to move closer to her children when she can't hear them, this frustrates her.

USER PROFILE

SARAH DELUNA

"The ear is the gateway to the mind, and it is my job to ensure that everyone is able to communicate with the world."



Gender	:	Female
Age	:	49
Education	:	Bachelors Degree
Occupation	:	Audiologist
Income	:	£45,000
Status	:	Married, 1 daughter

BIOGRAPHY

Sarah is a audiologist from the Dominican Republic with 20 years of experience working in the Central Hospital. In early 2020, she developed early-onset arthritis, which often caused her discomfort when filling out patient information forms and operating testing equipment. Her passion for her work has led her to try out EAV this year to provide mobile hearing tests to different groups of people. She will work as both driver and operator of the EAV, travelling all over the city.

GOALS

- Operate instruments without interference from joint pain
- Provide more convenient hearing tests for the public
- Ensuring the quality of hearing exams
- She would like to urge people to check their ears regularly

FRUSTRATIONS

- Arthritis attacks at work
- Prolonged driving may cause elbow discomfort
- She can't set up EAV with a lot of force

TECHNOLOGY

Software



Social Media



Mobile App



MOTIVATION FOR OPERATING EAV

Sarah's years of experience have taught her that offering hearing tests in hospitals does not serve all social groups. Some people do not want to take the time to go to the hospital for regular check-ups, while others have difficulty travelling due to age or physical limitations.

She therefore volunteered to try out EAV, a transportable medical unit that can visit all corners of the city to promote hearing protection while providing easy access to audiological tests for as many people as possible.

USER PROFILE

ALEX SENIOR

"I take everyday as it comes. I need my health to keep up with my active lifestyle"



Gender	:	Male
Age	:	25
Education	:	BA Media studies
Occupation	:	Photographer
Income	:	£50,000
Status	:	Single

BIOGRAPHY

Alex is a 25 year old freelance photographer who studied Media at Goldsmiths University in London. With his job, Alex is often away from home for long periods of time so he often finds it hard to book things like doctor appointments and health checks. He is also often exposed to very loud noises and music when photographing events like motorsport and concerts.

GOALS

- Ensuring his body and health function to a good level
- Make sure his hearing doesn't not effect his work
- Understand hearing loss

FRUSTRATIONS

- Do not have knowledge on hearing
- His hearing is starting to effect his job and home life
- Don't have the time to go in for a test

TECHNOLOGY

Software



Social Media



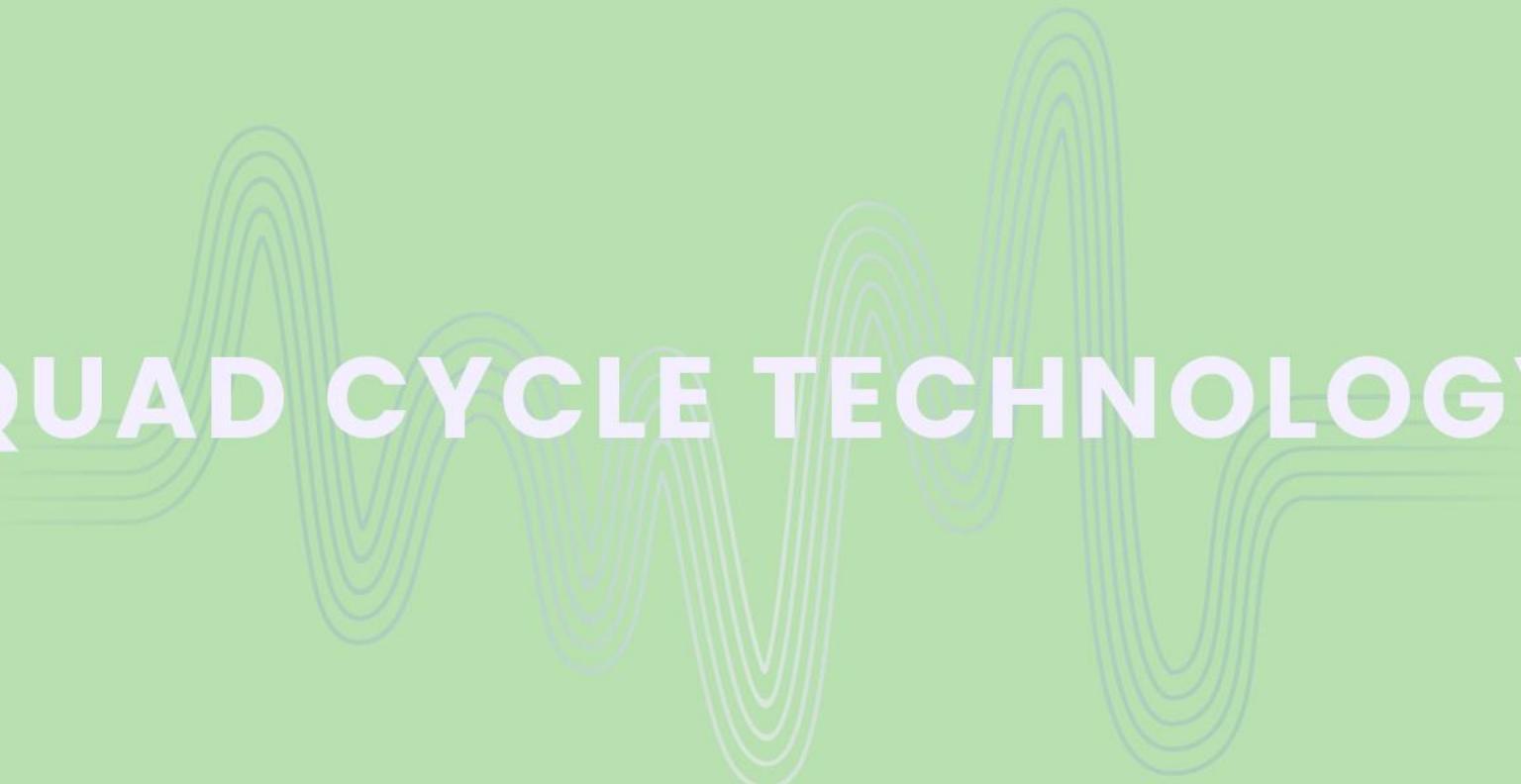
Mobile App



MOTIVATION FOR GETTING TEST

Over the last couple of months, Alex has noticed his hearing has not been normal. He feels like after he is exposed to loud noises his hearing takes longer to readjust back to normal and he often has ringing in his ears. This can be frustrating to Alex as he finds the ringing distraction when trying to work or focus on a task.

Alex would like a way to be test quickly and conveniently as he doesn't have much time to spare.



QUAD CYCLE TECHNOLOGY

QUAD CYCLE TECHNOLOGY RESEARCH

HANDLE BARS



Riser Bars

Very classy, comfortable and simple. Appropriate for men and women. Easily available to buy, requires reach from the saddle unless placed unusually high



Cruiser Bars

Dutch style handle bars, support good posture practices. This would be good to use with a comfortable seat. Can be hard to balance if new to this style but 4 wheels would solve this issue

THUMB THROTTLE



Most E-bikes use a standard 1-7 dial to show the gear of the bike. This adheres to the regulations surrounding e-bikes in the UK since you

cannot go without pedalling. The further you push down the throttle, the more assistance you get from the motor. This means that the bike is safe to use in cycling lanes but is less intensive on the operator, especially while tackling hills

SADDLE



The saddle will be used by both men and women and so needs to be of a unisex design. A saddle like this is great because it has lots of padding which will make the operator's experience much more comfortable.

CONTROLLER



From research, e-bike/quad bike controllers tend to come as either 36V or 42V and seem to be either 500W or 1000W respectively. Since this bike would be larger and would

be required to carry more weight, it would be better to use the higher powered controller. We are planning to use a separate battery for the lights, windscreen wipers and other extra electronic details that would be charged up by a solar panel so we would use a second controller (of the same kind) for these elements

PEDALS



The pedals for this product do not need to be of a particular size, shape or brand. They are simply pedals however a good quality pair would be preferable. I have chosen these as they are on the higher end of quality.

SUSPENSION



The key factor of the suspension is that it needs to be lightweight but also strong enough to support the weight of the ride and medical supplies over bumps and potholes.

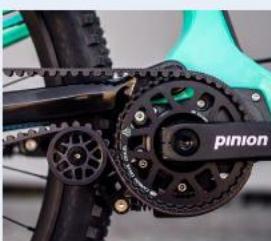
- Independent axle suspension (top)
Both sides of the axles have their own set of dampers and springs which move independently. this means all wheels can be at different heights at any given time.
- Leaf spring suspension (bottom)
Leaf spring suspension is by far the most simple form of suspension. one solid axle is mounted to two sections of flexible steel that helps to absorb humps in the road.



DRIVE CHAIN



Gears and chains
Most E-bikes use standard metal chains and gears to convert the riders pedalling strokes to movement.



Pinion Gear Box and Belt

An alternative to standard metal gears is a belt and pinion gearbox system. It works in a very similar way but instead of the chain being moved to change gear, a gearbox is used.

There are many advantages to using this type of system. Firstly the gearbox is closed off to the elements so requires much less maintenance and also runs smoother. Belted systems also do not require any lubricants so even less maintenance is required. The combination of the two create a highly efficient, durable and long-lasting drive train

A company called **Pinion** already produces a belt drive gearbox that could be integrated into a quadcycle.



QUAD CYCLE TECHNOLOGY RESEARCH

BATTERYS

The battery used in the EAV can have an effect on a number of factors including overall speed, acceleration, and most importantly range.

- Voltage

"Electric bikes typically come with a 48-volt or 52-volt battery. The difference between the two is power and performance: A 52V battery delivers better performance. A higher-voltage battery provides greater efficiency, with the battery using less electricity to provide the same or better power for the bike"

- amp hours

"Battery capacity is measured in Ah, or Amp-hours. As the name suggests this means how many amps the battery can deliver in an hour. For example, a 12V lithium battery with a capacity of 100Ah can deliver 100A to a 12-volt device for one hour."



BREAKING SYSTEM

Mechanical Disk Brakes:

Mechanical disk brakes have a selection of advantages over hydraulic disk brakes. For example:

- They are more efficient than most other types of brakes
- They are easier to fix, which is important considering the operator of the hearing test will need to fix them if something goes wrong.
- They are cheaper, therefore making our product cheaper to produce



Hydraulic Disk Brakes:

Hydraulic disk brakes, whilst they do apply a greater braking force, are harder to fix by oneself and since they use oil, have the possibility of getting chemically worn down.

They do require less maintenance but overall the pros for mechanical brakes outweigh those for hydraulic ones.

WHEELS / MOTOR

With E-bikes there are two main types of motor power.

- Wheel motors
- Inline motor



- Wheel Motor

Wheel motors put simply are wheels with a motor built into the hub. They are easy to work with as normal hardware can be used.

- Inline Motor

Inline motor work by adding power to the input side of the drive train. In most electric bikes this is done between the cranks and drive sprocket.

- Motor Speed and Power

For the EAV to be able to travel in bike lanes it is restricted to a maximum of 25 km/hr. There are also restrictions on the motor power output of 250 watts.



STEERING MECHANISM



Movability is key for the quad cycle so that it can be nimble and turn corners safely. The main areas that need to be covered are cornering speed, steering angle, and turning radius.

- Mechanical linkage

A simple system comprising of steering rods, pull rods, and steering knuckles can provide a quad cycle with a sufficient level of steering control. This type of steering mechanism is also compatible with most suspension types meaning simple integration.

During turning the steering components can be subjected to large linear forces so the construct must be strong enough to deal with these loads.

- Back Wheels During Steering

When a four-wheel vehicle steers the back two wheels travel different distances. As a result of this steering can be affected. To combat this a differential can be added to the axle. A differential allows the wheels to turn at different speeds. Ackermann's Principle can also be used.



MEDICAL CONTENT RESEARCH

Device	Description	Approximate size (mm)	Approximate weight (kg)
Otoscope	Allows audiologist to look into patient's ear using a microscope and light	71 x 132 x 48	0.1
Headphones	To be placed over the patients' ears for part of the test	Earmuff diameter – 70 Plug diameter - 65	0.52
Mini microphone and headphones for babies'	These are inserted into the baby's ears during the Otoacoustic Emissions Test	5 x 10 x 5	0.003
Audiometer (Generic)	Device used to evaluate the hearing threshold of a person; it is normally connected to the headphones	320 x 224 x 81	1.1
SP85A Audiometric Speaker System	A speaker which is specifically designed to be used in Free Field Audiometric testing. It has limited resonance and distortion of sound	160 x 105 x 135	1.4
Tympanometry device	The small device placed behind the patient's ear drum, during a tympanometry test	180 x 135 x 23-41	0.57
Dehumidifier	To control moisture levels (as too much moisture can be detrimental to hearing aids)	130 x 85 x 30	0.23
Vacuum control system	To clean hearing aids (sucks up debris from inside the tubes and small spots)	213 x 211 x 119	0.71
Wax softening drops	If wax is soft enough to remove on the spot, they will use these in the EAV, otherwise they will send the patient home with them	31 x 70 x 15	0.028
Bulb syringe	To aid wax removal	104 x 59	0.001
Cerumen forceps	For fitting and removing extended wear hearing devices	75 x 1.5 x 30 In package – 165 x70 x 3.05	0.03
Hearing aid replacement parts and batteries	A stock of these can help patients in remote areas	Multipack – 100 x 60 x 50	0.1
Audio wipes canister	To clean all non-disposable equipment and prevent infection	160 x 98 (circular diameter)	0.54
Fold out chair with legs	A chair for the patient to use. Fold out as people in wheelchairs won't need to use it, plus it saves space.	573 x 137 x 538	0.004

The table above shows the medial devices and furniture needed within the EAV in order to carry out hearing tests.

EXTRA NECESSARY CONTENT

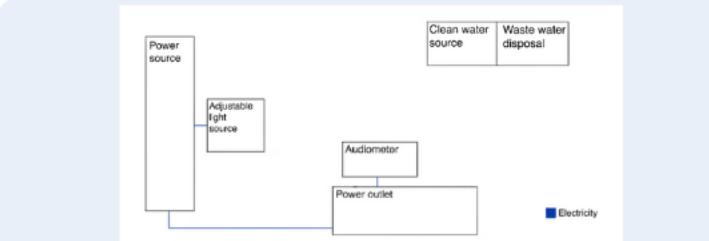
Waste disposal bins for items such as audio wipes

- Small, potentially compactable bins

Waste disposal for grey water and storage for clean water

- Grey water is relatively clean water which needs to be disposed of appropriately.
- Can be placed into a 5L tank each, labeled clearly for disposal or use, with a large opening to allow for ease of access. A standard 5L tank of this description has dimensions of 270 x 150 x 150 mm.

SCHEMATIC FOR ELECTRICAL COMPONENTS



THE PROCESS

For a baby:

Otoacoustic Emissions Test (OAEs)

- A miniature earphone and microphone are placed in the baby's ears. Next sounds are played and a response is submitted.
- If the baby hears normally, the microphone will measure the sound of an echo being reflected back by the ear canal.
- However, if a baby has hearing loss, a reduced echo or sometimes no echo is received on the audiometer.

For an adult:

The test is more complicated and takes between 30mins to an hour.

- First there is a discussion about the patients work and lifestyle, as well as any hearing concerns and medical history.
- The audiologist will use an otoscope to do an examination of your ears.
- If they find the issue is excess ear wax, and the wax is soft they can remove it on the spot. Otherwise they will give you softening drops to use at home.

Pure Tone Audiometry Test

- Headphones are placed on the patients ears and sounds are played.
- Patient raises a hand or presses a button every time they hear a sound.
- The results are immediate and show the quietest level which the patient can hear.

Speech Perception Test

- The same steps as the process above, however, the patient hears speech rather than sounds.

Tympanometry Test

- A small device is placed behind the patients ear drum. This check for fluid behind the eardrum, and also measures how well your eardrum moves.

Free Field Audiometry Test

- For individuals who cannot wear headphones.
- A speaker is placed Infront of the individual in the soundproof room, and then the test is carried out as usual.

MEDICAL CONTENT RESEARCH

CURRENT ACOUSTIC BOOTH

AMPLIVOX ACOUSTIC BOOTH 250S	
Exterior Dimensions	730 x 990 x 1945mm
Interior Dimensions	604 x 860 x 1680mm
Weight	295kg net
Construction	53mm thick Noishield® panels—plain galvanised steel exterior surfaces and perforated galvanised steel interior surfaces.
Door	One 604mm wide x 1680mm high (clear opening) Noise-Lock® door. Self-aligning magnetic compression seals are mounted on the top, bottom and sides of the door leaf.
Window	One double glazed unit comprises 6mm thick safety glass fitted in aluminium frames; clear view 750mm high x 600mm wide.
Ventilation	Ceiling panel contains a Tranquil-Aire® all-in-one silenced forced ventilation system.
Lighting	LED Maintenance free, ceiling recessed light
Seat (Internal)	Fixed bench seat, 450mm deep. Colour: black.
Floor	Covered with a foam-backed nylon carpet

The table above shows the detail of a current acoustic booth named Amplivox 250S



POWER SOURCE AND WATER SUPPLY

For the EAV a leisure power supply would be needed to supply the products listed on the previous page, such as the audiometer, speaker and potentially the light. We will not need to include a water system as the quantities of water are very low and for the ear wax removal service, the audiologist can fill up their bulb syringe from a simple water source (ie, from a tank).

For this product a 12 volt battery would be suitable, as whilst not being too big, it would still be able to supply all of the necessary components. Alongside this we would need an inverter, which could increase the voltage of this battery to make it suitable to be used for products such as the audiometer. We would also require a 3 pin socket to charge some content, this can be connected to an electricity wire which would run around the wall of the EAV. The schematic on the previous page, shows a basic model of the power supply and how it is connected.

ELEANOR WEBSTER

EVALUATION ON 250S

The dimension of Amplivox 250S is quite close to the expected test room dimension in a EAV. Using professional sound proof thick wall and door, it has excellent performance in insulating noise. Plus, almost all the equipment is placed in fixed position, like seat and lighting, which helps build an accurate test environment. Silence ventilation is installed for a good Air circulation. LED light is maintenance free, promising a long using life. Moreover, it is recessed in the ceiling and saves space. The only pain point is that the weight is too heavy and not suitable for an EAV.

REQUIREMENTS FOR TEST ENVIRONMENT

Low Ambient Noise Levels: no more than 30 dBA (a low-voice conversation)

Reverberation Times: no greater than 0.25 seconds inside an audiology room

A Defined Layout: Furniture and equipment placed in fixed position

Doors, Windows & Ventilation: sound attenuating doors, windows and ventilation systems

Position of Loudspeakers: positioned at head height and angled directly at the reference point from minimal 1m away

For the adults tests it is not necessary to have a completely sound proof room, however a quiet area is necessary. Since this product will be used on the road, it is likely to be necessary to have some soundproofing involved.

SOUND PROOF MATERIAL

While current acoustic booth has an excellent performance, the main issue is that it uses metal a lot, leading to a high weight.

It is found that a new fabric, SonoLayr, is thin and light weight, which can be a good option.



QICHENG LIU



STANDARDS & LEGISLATIONS

MEDIC AND PATIENT STANDARDS & LEGISLATIONS

MEDIC RELATED

1- Medical License / Certification

As the EAV driver needs to be a qualified audiology medic, they require a medical license. To attain one, "doctors are required to provide evidence of an acceptable primary medical qualification, skills and capabilities" [1]. Especially in audiology, a very sensitive field. According to the HCPC, to practice as an audiologist in the UK, one must be registered with the Health and Care Professions Council (HCPC). They must meet the HCPCS's standards of proficiency for their profession and have earned an approved degree or an equivalent qualification in order to register. [2]

2- Driver's License

Based on the license regulations of the UK government, the EAV being designed will fall under the category B license, being under 3,500 Kg. [3] This also backs up the fact that there will be times the vehicle will be driven in the road among cars, which requires driving standards and regulations.

3- Medical EAV Certification

EAVs are a rather new and modern concept; hence, they do not fall under standard medical training. To be able to operate in an EAV as a medic, special training is required that covers understanding of the vehicle, its mechanism, the utilities, the emergency procedures, and safety processes.

PATIENT RELATED

1- Patient Safety and Security Standards

The entire medical procedure should adhere to general safety and security standards as well as audiology standards. This includes making sure the patient understands the process, the use of sanitary products, gloves, professional use, and the recording of information, perhaps through CCTV cameras as well.

2- Patient Confidentiality

Different patients come from different backgrounds and mentalities; therefore, it is important to assure the patients that their information and procedure is in safe hands and is not to be disclosed to anyone as disclosure is required by law, unless the patient agrees.

3- Patient Comfort

Along with the medical space and furniture, a relaxed mind of the patient is severely important for a safe procedure. Sensitive topics, inappropriate actions or words, and an uncomfortable environment should be strictly prohibited.

EAV STANDARDS & LEGISLATIONS

EAV BUILD RELATED

1- Electrical Equipment Regulations

The EAV must comply to electrical equipment standards that adhere to safety standards in the possible case of shock, fire, or overload. **The Electrical Equipment (Safety) Regulations 2016** is set for electric vehicles that entail electrical equipment intended for use with a voltage rating of between 50 and 1000 volts for alternating current or between 75 and 1500 volts for direct current. [6]

2- EAV Dimensions

Different electric vehicles relate to different purposes, which yield to a set of dimensions. According to **The Road Vehicles (Construction and Use) Regulations 1986**, the EAV counts as a motor vehicle, which falls within the maximum restriction of 12 m x 2.5 m x 4.2 m. [7]

3- Breaking and Steering Systems

For control safety, the EAVs must contain a secure braking and steering system under **The Road Vehicles (Construction and Use) Regulations 1986** that is viable for repair, maintenance, and acceptable performance. [7]

EAV BUILD RELATED

4- Lighting and Signaling

The EAV, especially in the medical field, should hold lighting and signaling standards with additions to implementing sirens if necessary for emergencies, in accordance to **the Road Vehicles Lighting Regulations 1989**. [8]

5- Body Integrity and Corrosion Protection

As the weather in the UK could be quite demanding in terms of materials, it is necessary to ensure that the EAV is formed from corrosion and wear resistant materials. Following **The Motor Vehicles (Construction and Use) Regulations 1986**, both the bodywork and chassis must be designed and constructed to prevent the ingress of water, dirt, and other debris. [9]

6- Insurance

The Road Traffic Act 1988 states that all motor vehicles (including electric motors) must have at least a third-party insurance. This covers possible damages in accidents or injuries of the driver. [10]



ERGONOMICS & ANTHROPOMETRICS

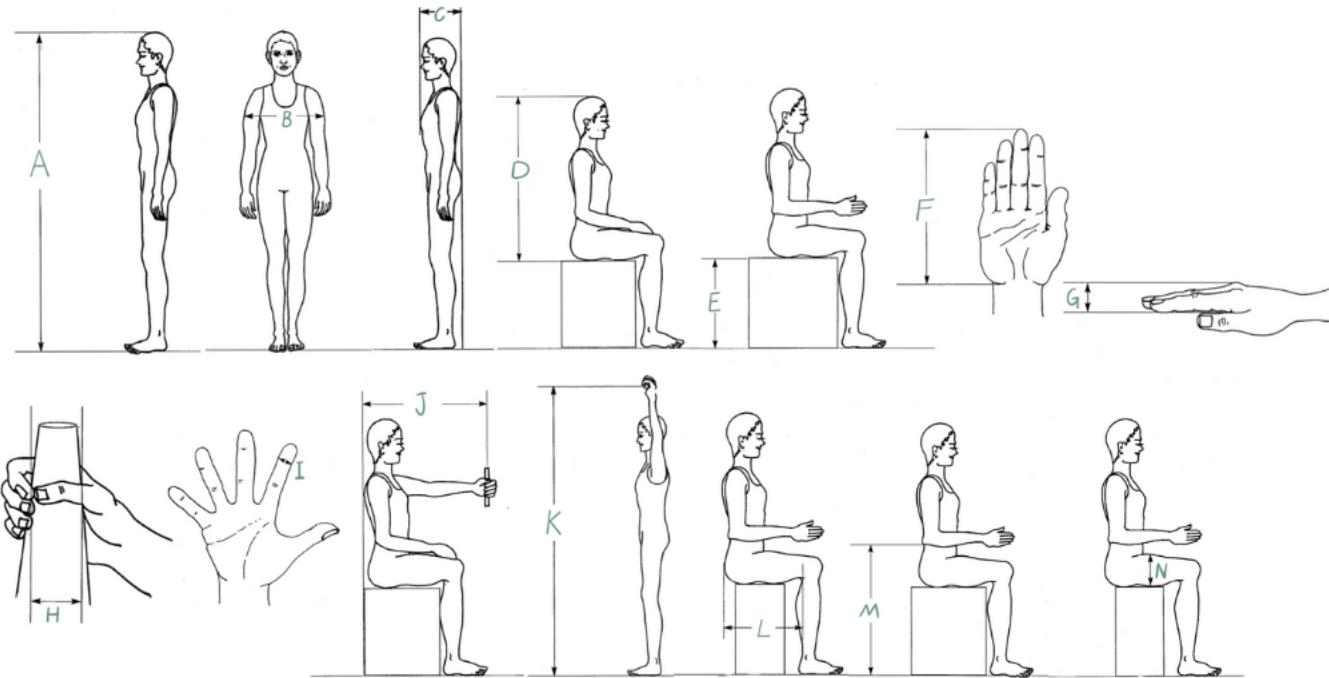
ANTHROPOMETRIC DATA

All dimensions in millimetres

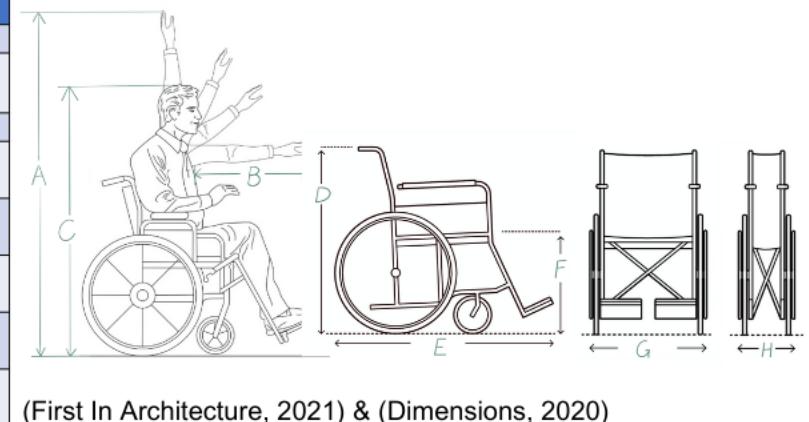
Code	Measurement	Male Mean	95th Male	5th Female	Female Mean
A	Stature	1755.1	1869.2	1514.4	1620.02
B	Whole Body Breadth	569.9	627.1	382.2	455.0
C	Whole Body Depth	336.8	379.6	219.6	272.6
D	Sitting Height	920.2	980	803.4	857.6
E	Seat Height	425.7	468.8	351.8	395.5
F	Hand Length	189.8	206.0	159.0	175.0
G	Hand Depth at Middle Finger Knuckle	29.7	33.5	22.1	26.2
H	Finger Grip Diameter	40.9	45.8	32.1	37.2
I	Index Finger Breadth	18.2	20.0	13.0	15.1
J	Forward Grip Reach	737.6	804.8	617.9	681.6
K	Overhead Grip Reach	2093.2	2244.9	1824.7	1944.3
L	Buttock To Back of Knee	517.2	574.8	435.1	495.1
M	Sitting Elbow Height	669.5	713.6	584.8	627.2
N	Thigh Depth	166.8	197.7	116.6	153.7

Figure 1: Anthropometric measurements for normal user

(Peebles, 1998)



Code	Measurement	Male Mean	Female Mean
A	High Reach	1715	1575
B	Forward Reach over Table	580	510
C	Head Height	1330	1255
D	Wheelchair Height	914	
E	Wheelchair Length	1067	
F	Wheelchair Seat Height	495	
G	Wheelchair Width	63.5	
H	Wheelchair Width (Folded)	28	

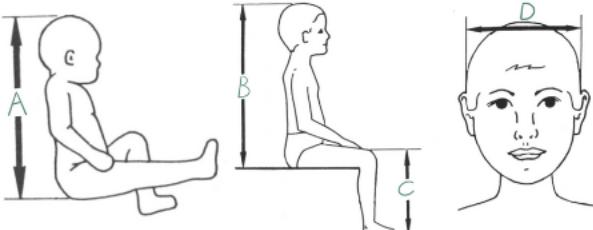


(First In Architecture, 2021) & (Dimensions, 2020)

Figure 2: Anthropometric measurements for wheelchair user

Code	Measurement	Infant (9-11 months) Mean	Children (11.5-12.5 years) Mean
A	Crown-rump Length	19.0	-
B	Erect Sitting Height	-	30.7
C	Knee Height	7.9	19.0
D	Head Breath	4.9	5.8

Figure 3: Anthropometric measurements for infants and children (Susan, 1987)



ERGONOMIC ANALYSIS

• POINTS OF INTERACTION

Physical environment: The size of EAV should be 3m x 1m x 2m (L x W x H) while driving area takes up half of it. The wind blowing over the driver's seat, the noise, temperature and brightness in the cabin must be controlled. These could perhaps be achieved by [windshield](#), [soundproofing equipment](#) and air conditioner, etc.

Storages: There may be both high (fixed to the wall) and low (placed on the floor) [cabinets](#) in the cabin. The higher cabinets should be accessible to 5% female users and the lower cabinets should be interactive for 95% male (F1.A, K). Here the [handles](#) and opening/closing way of the cabinet doors should be considered.

Seats: At the beginning of the hearing test, the operator asks the person being examined brief questions and takes down basic information about the person and his or her description of his or her hearing. The vehicle therefore needs to have space for [two people to sit face to face](#) and for the operator to write easily. The height and size of the seat needs to be suitable for 95% male and 5% female (F1.D, E, L). Note that the condition of subjects in wheelchairs also needs to be taken into consideration (F2. C, E, G).

Door: Overall size needs to be accessible to 95% male and wheelchair users (ramps may be required (F2.G)).

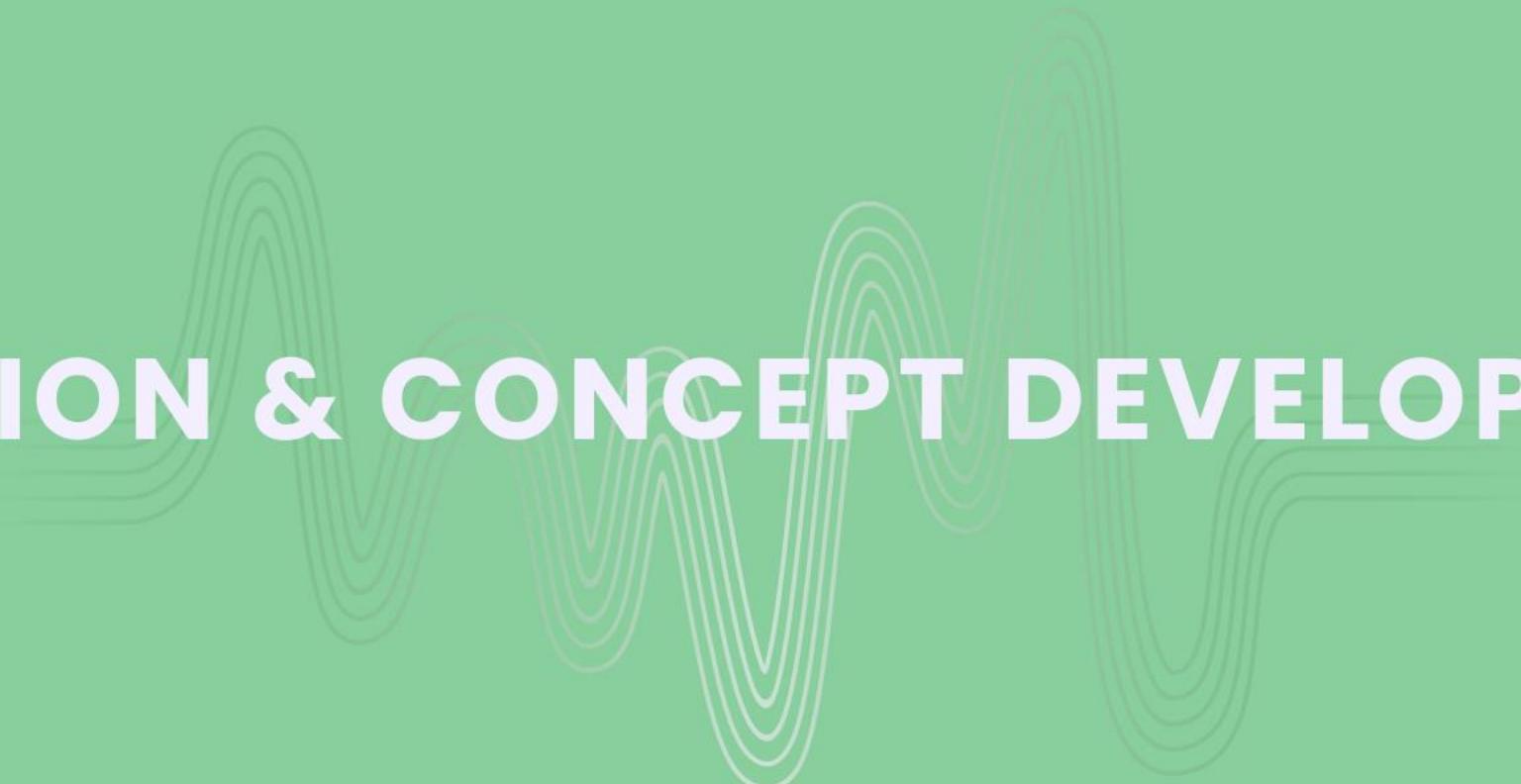
Test equipment: The test equipment is needs to be [stored](#) in an organised manner (e.g. headphones can be hung up, otoscopy devices need to be stored). It is important to note that during tympanometry, the operator walks behind a partition wall and observes the subject's reaction through a [viewing window](#) in the wall, without the subject facing the window (which would allow him to notice the operator's actions and thus influence his judgement), so the height of the viewing window should match to the height of the seat so that two people with the maximum height difference (95% male and 5% female) can see each other from both sides in a seated position (F1.D, E). In addition, the operator needs to operate the instrument on one side of the partition wall and also needs to record the measured data quickly, which makes a [table](#) of suitable height (refer to average elbow height) and sufficient size necessary (F1.M).

Switches and buttons: The [height of the switches](#) should be easily reached for 5% female, and the [size and layout of the switches and instrument buttons](#) should be easily interact for 95% male without accidentally touching (F1.A, I, J).

Driving area: The medic should be able to control the vehicle easily and remain comfortable during long drives, which requires the driver's [seat](#) to be sized for both 95% male and 5% female (F1.D, E, L), while the height, size and distance of the [handlebars](#) should also be taken into consideration (F1.G, H, J, M).

Tests for infants and children: For hearing tests on [infants](#) (10 months old in particular), the parent needs to sit with the infant in his/her arms in a chair where the infant can see the screen at eye level (Visual Reinforcement Audiometry), so the test area should be equipped with a chair and a screen of the right size and height (F1.N, F3.A). In the case of [children](#) (specifically 12 years old), the hearing exam (Pure Tone Audiometry) is similar to the process for adults, so as mentioned above, the medic has to be able to see the child's reaction from one side of the viewing window, which places requirement on the height of the chair (F3.B, C). In addition, [headphones](#) for infant and child head shapes may have to be prepared (F3.D).

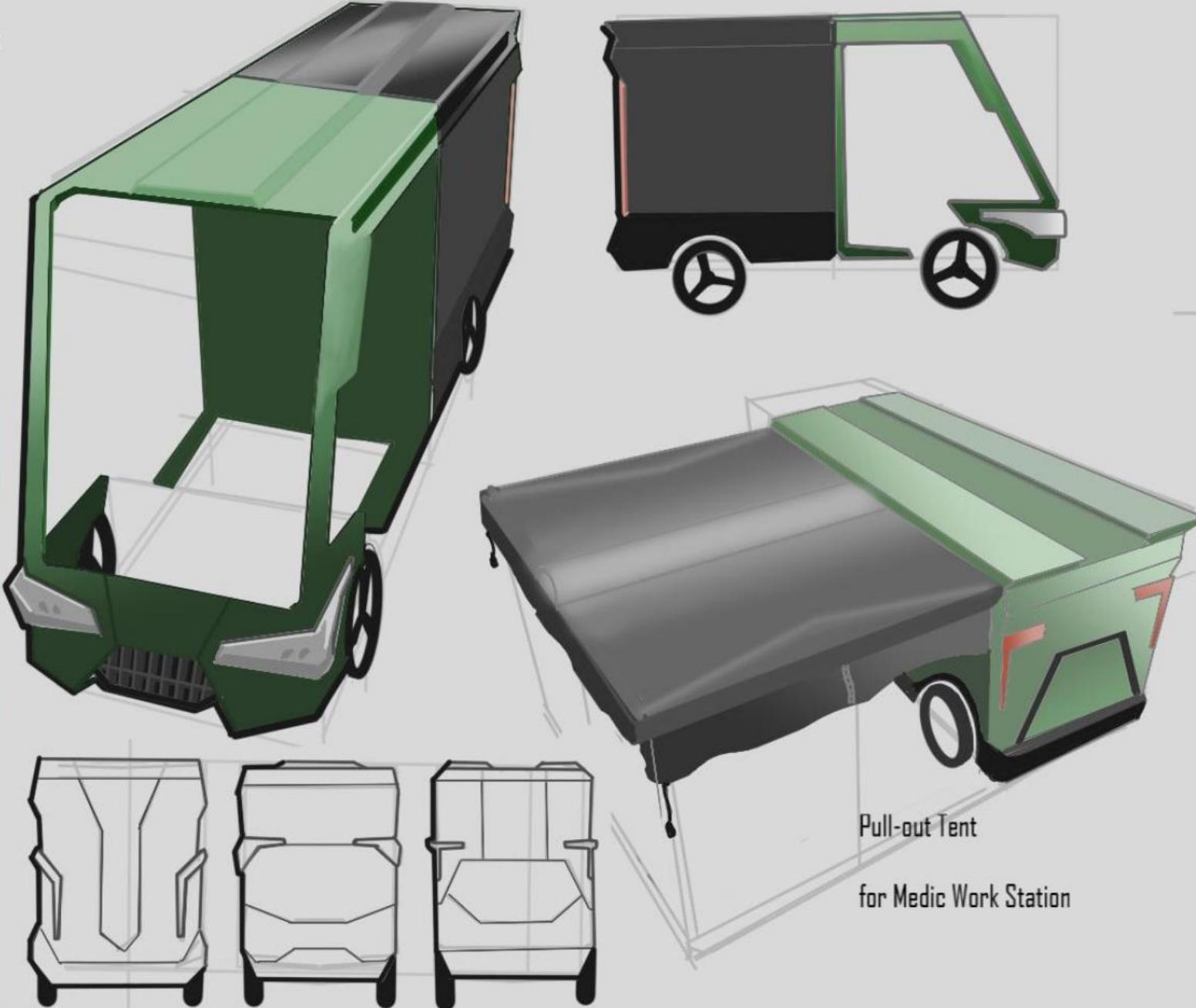
IDEATION & CONCEPT DEVELOPMENT



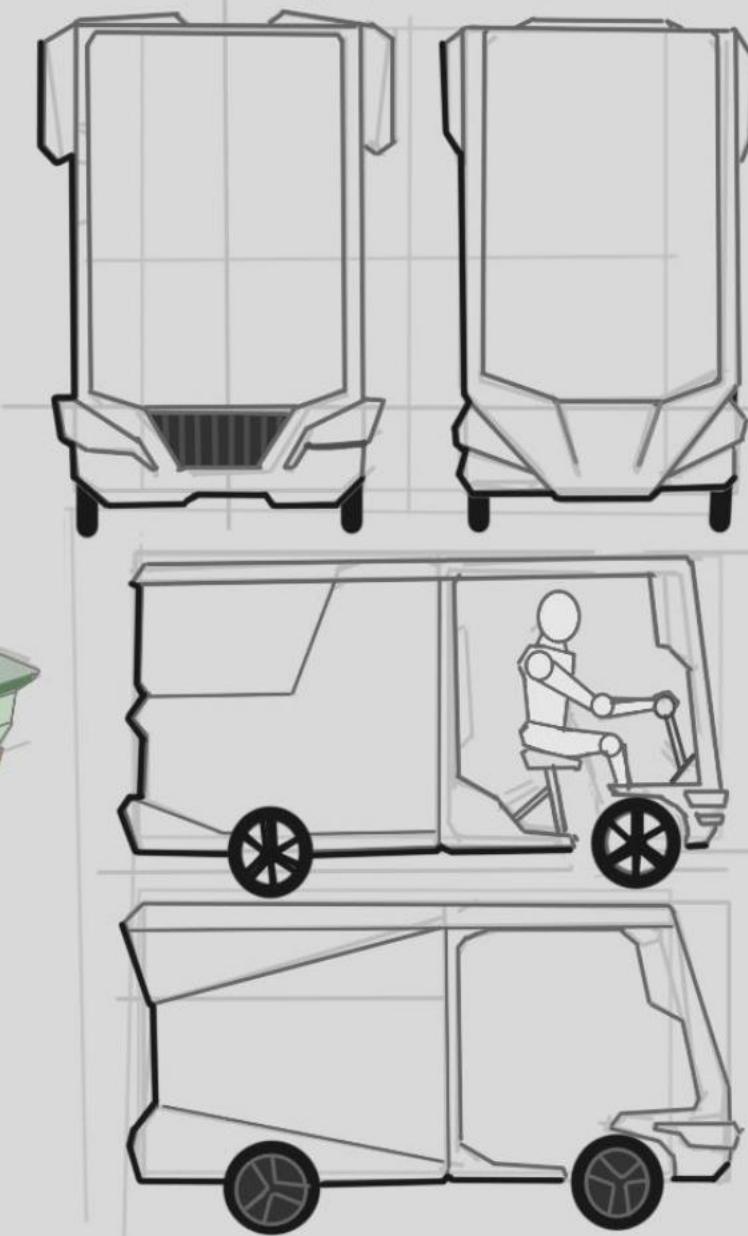
Exterior Design One

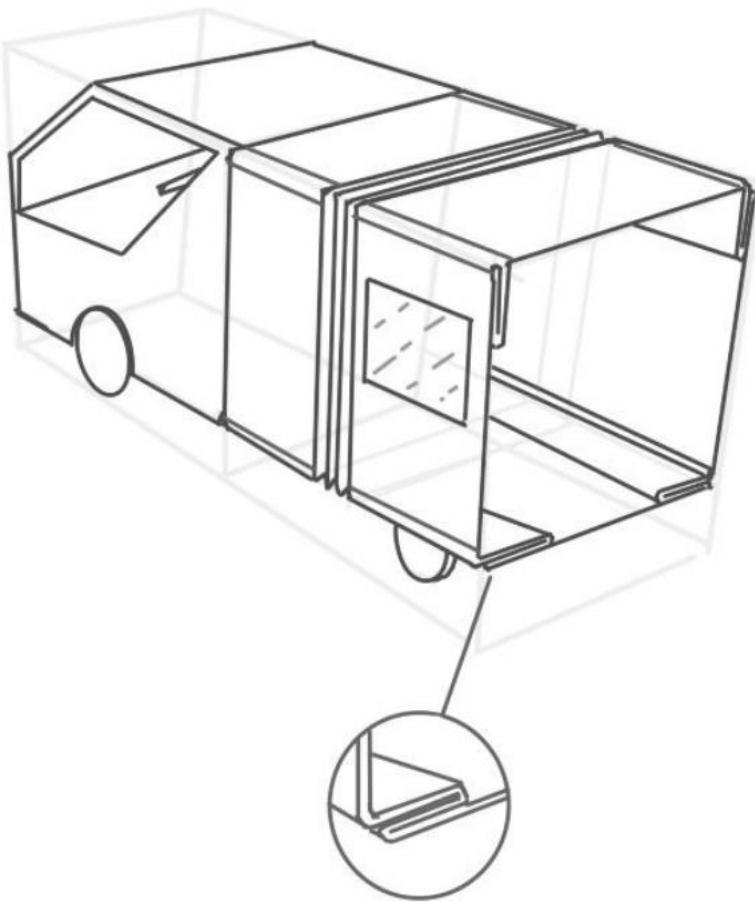
Name

Ideation and
Concept
Development



Orthographic Concepts



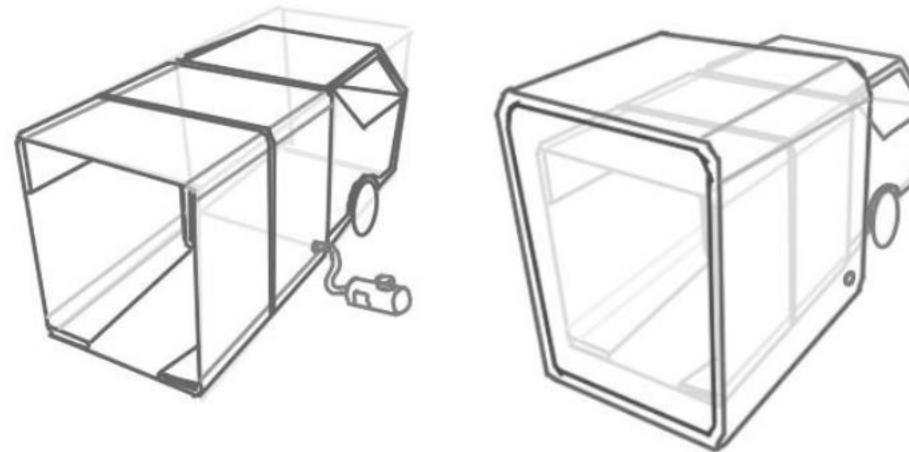
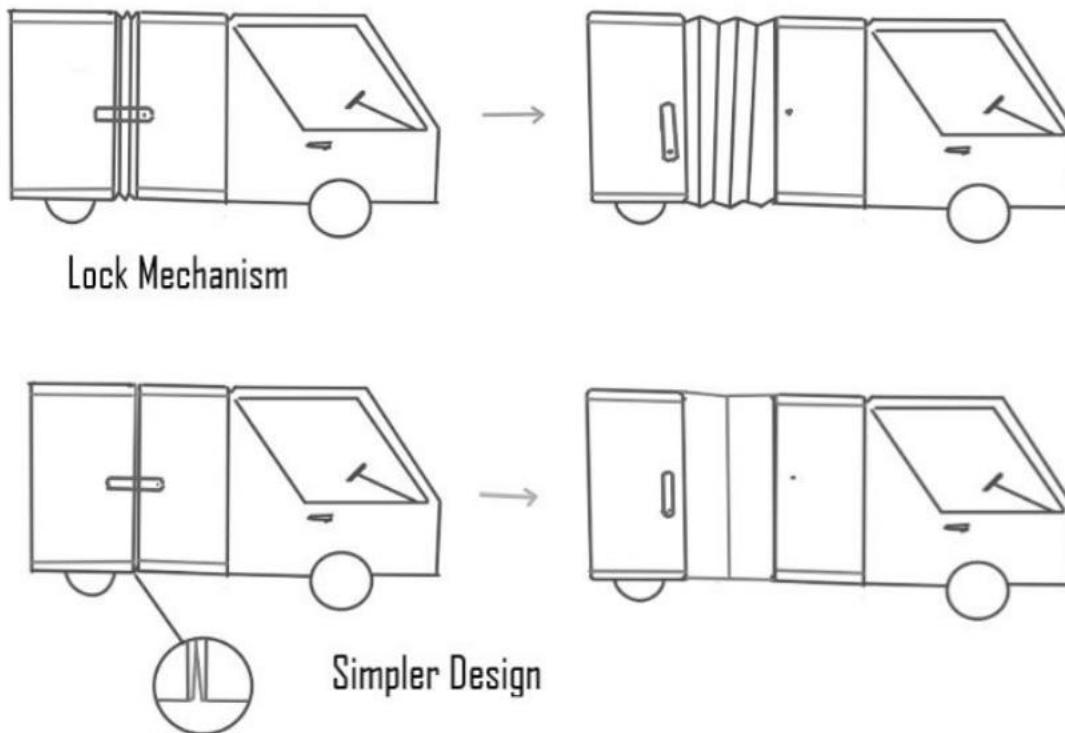


Inflatable Material:

-Allows extensions from all directions

Skeleton

Interior Skeleton holds the cubic shape



Pneumatic Roof



Transparent Flexible Material:

For natural light and aesthetic look



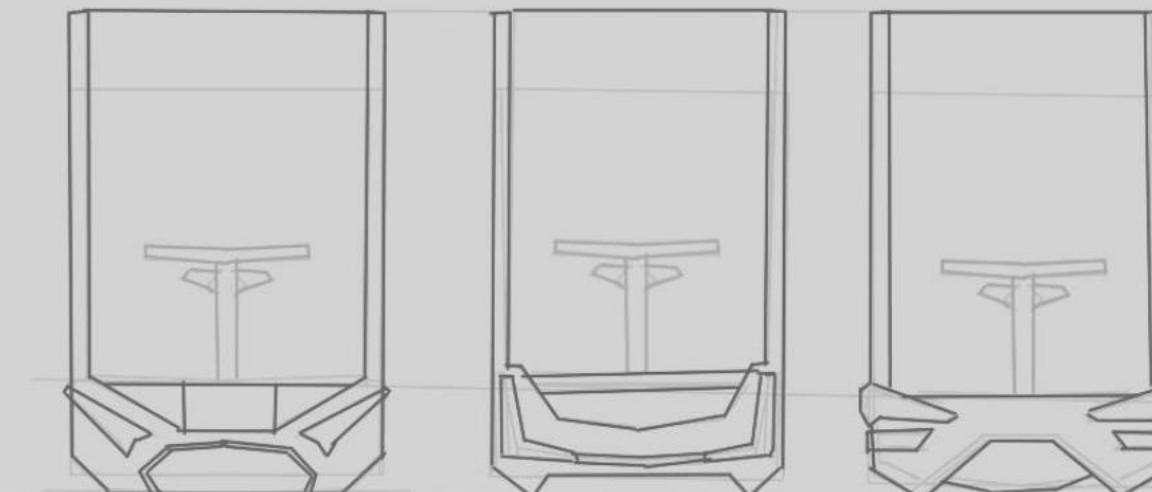
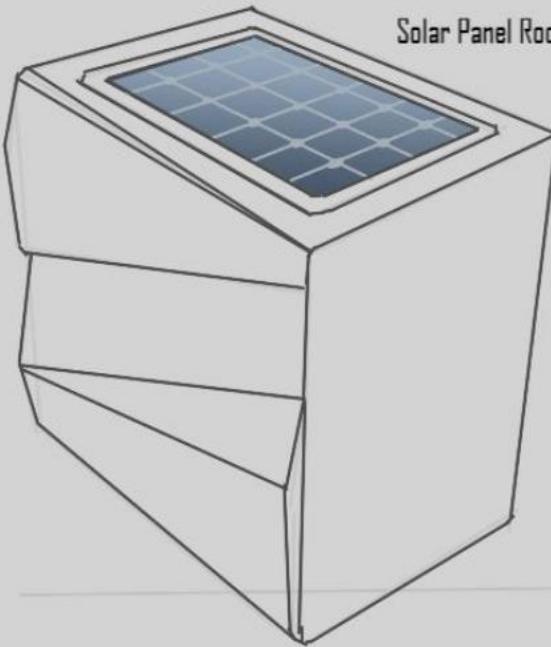
Pneumatic/Piston Mechanism

using air pressure



Additional Length Extension

Colour Scheme



Skoda Car Grill

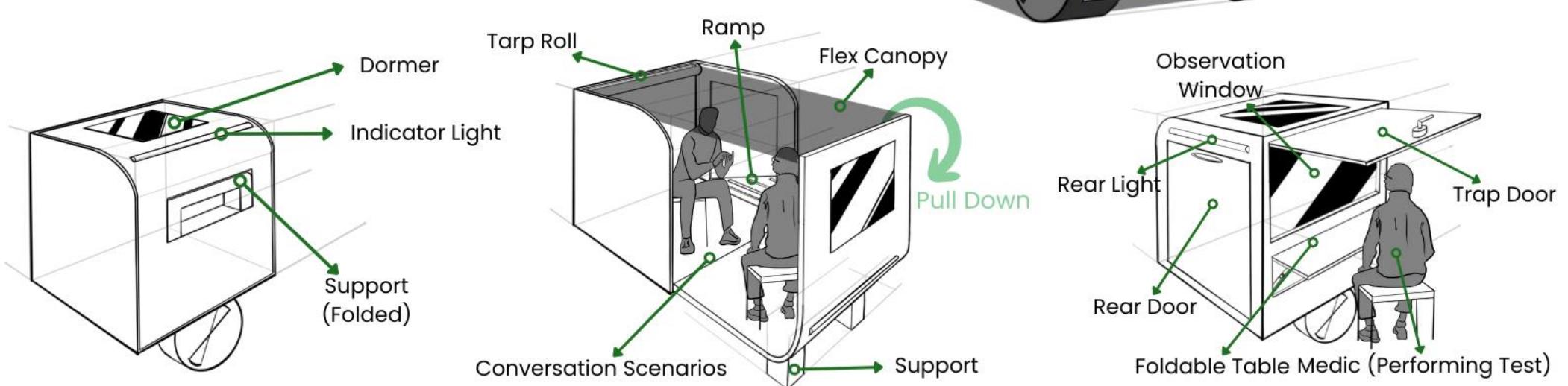
Skoda Modern Look

Skoda Multi Lights

Exterior Design Two

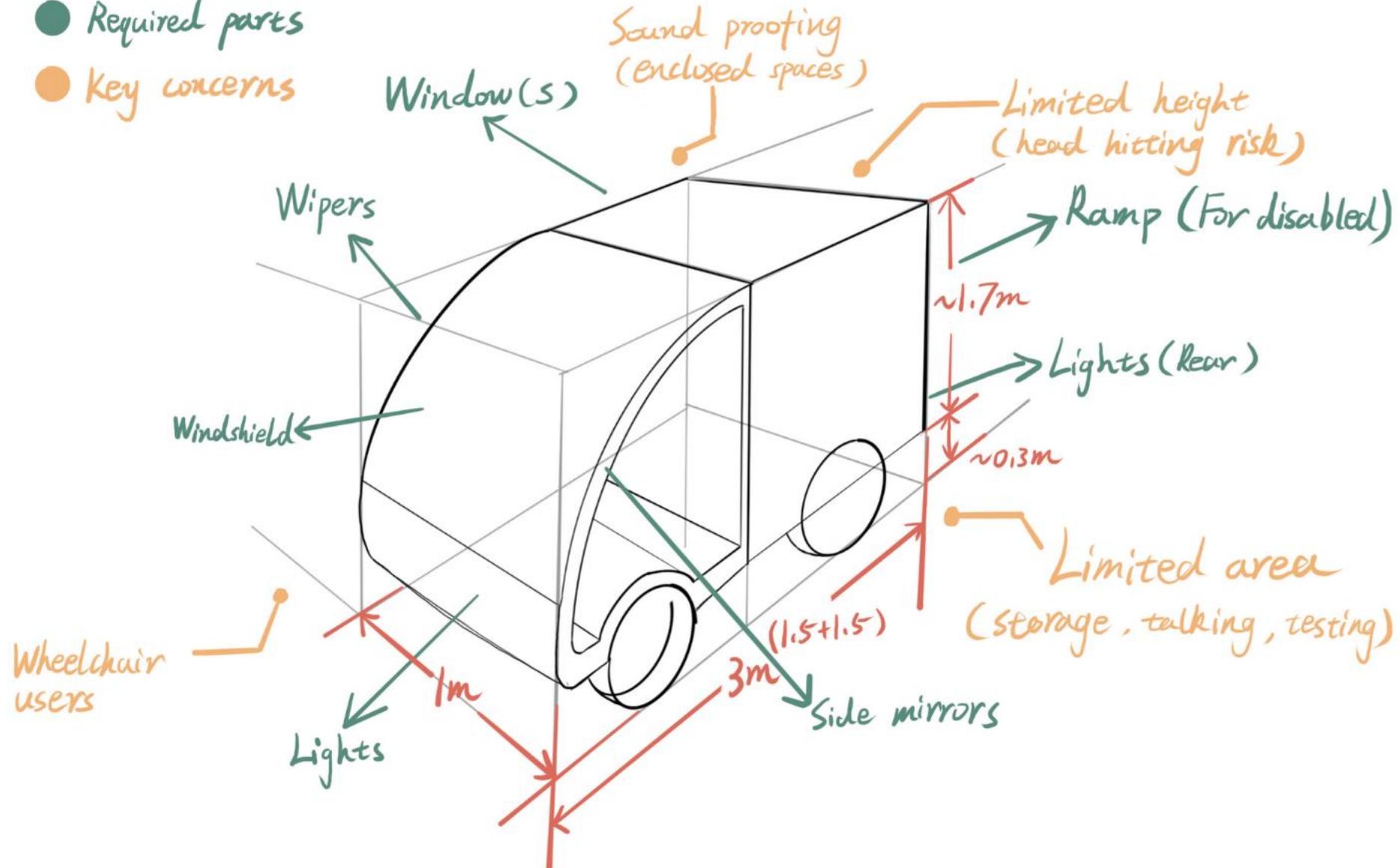
Jiashu Huang

Ideation and
Concept
Development

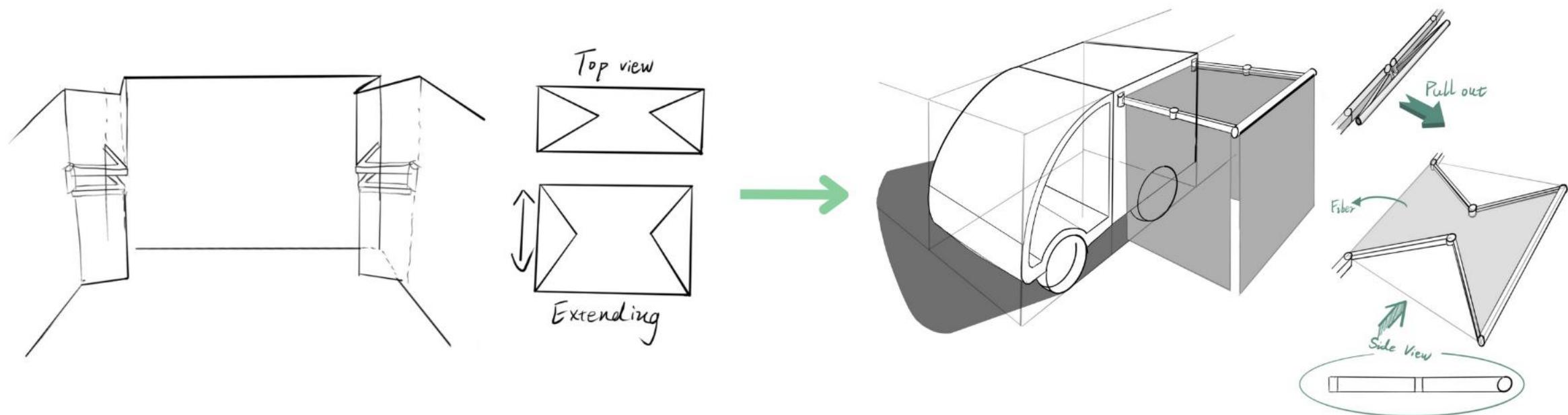
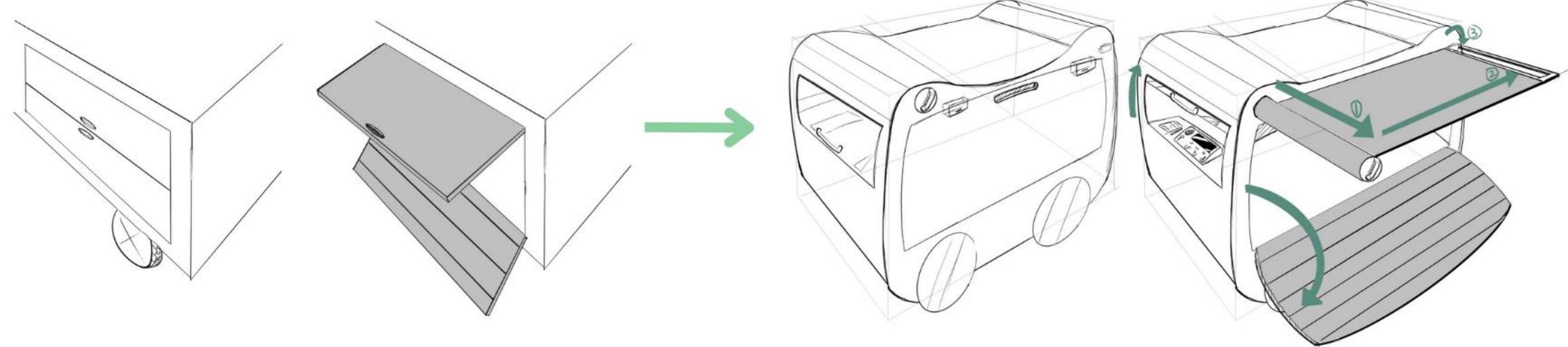


Ideation Concerns

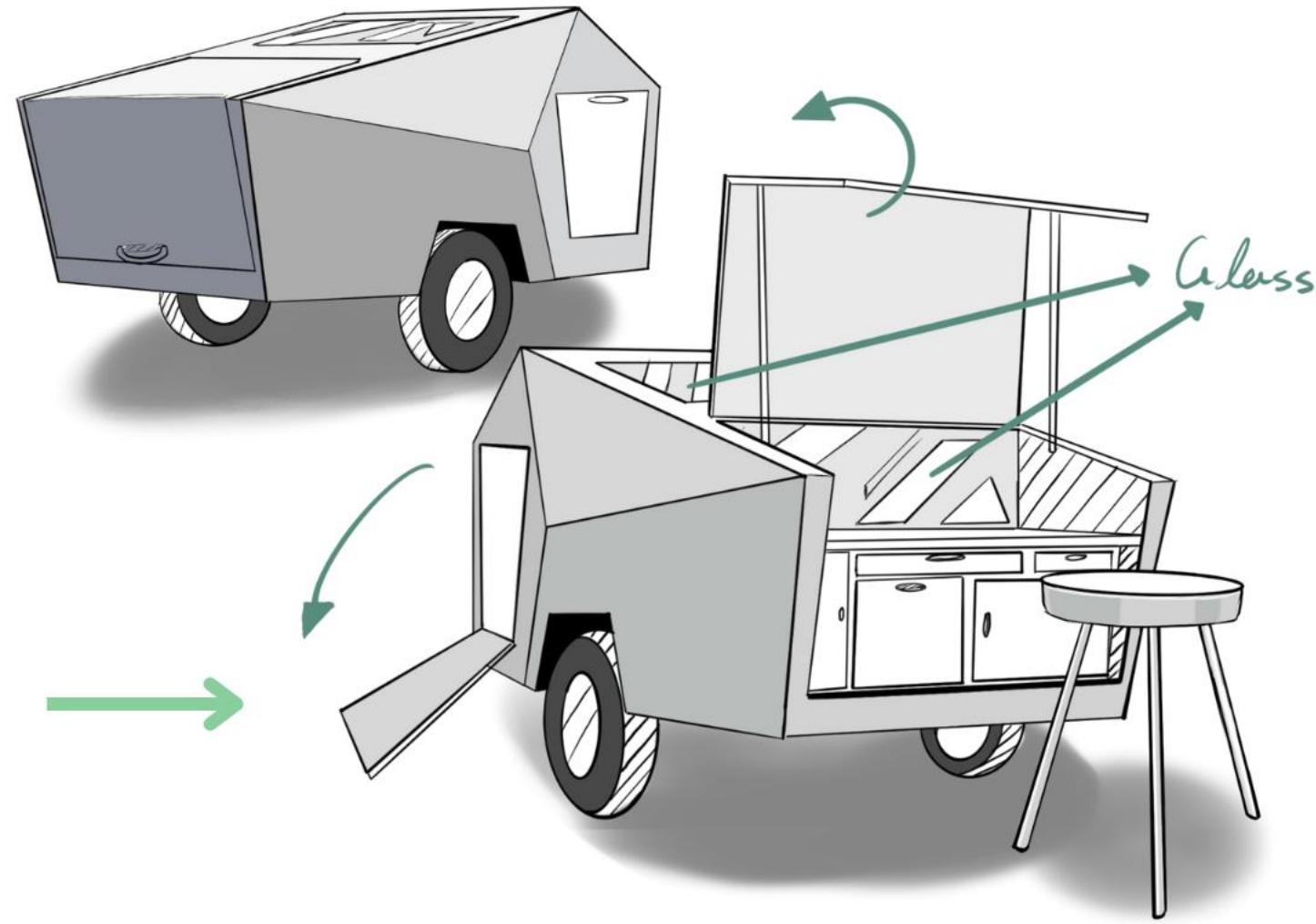
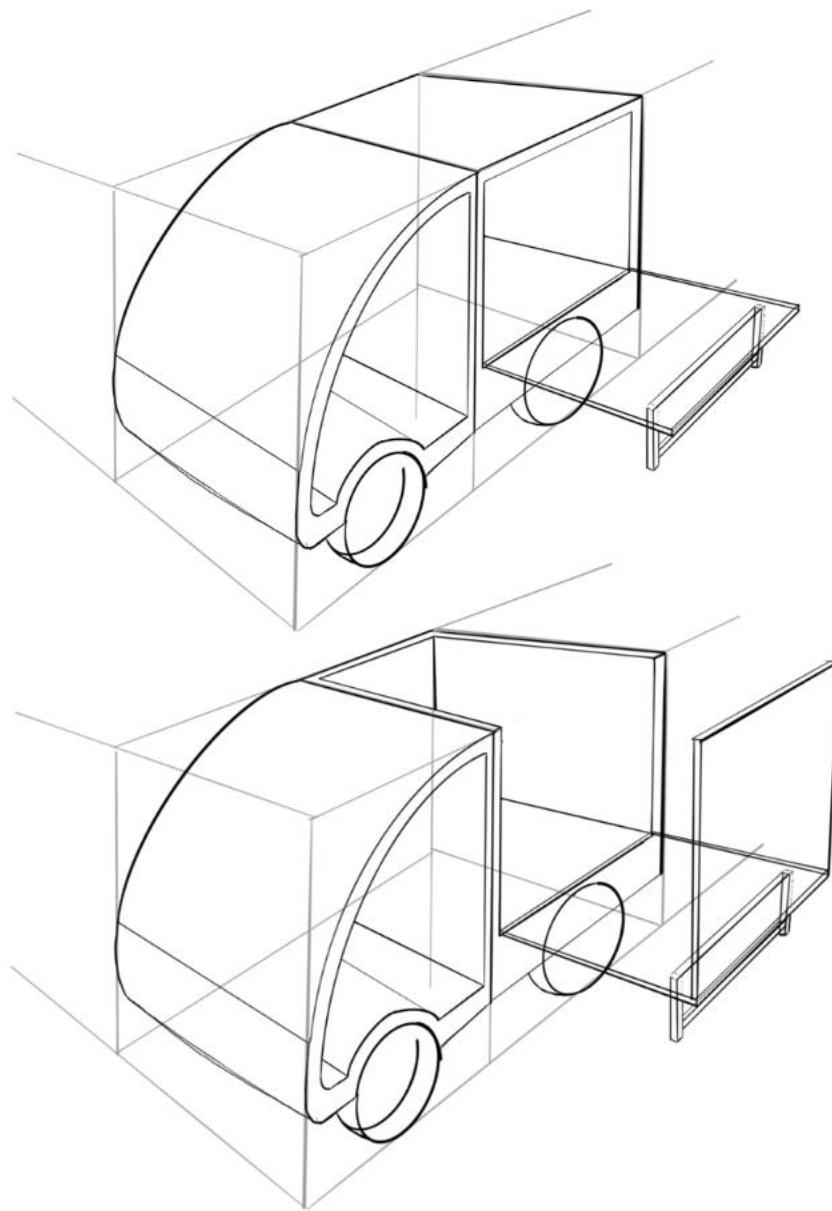
- Size restrictions
- Required parts
- Key concerns



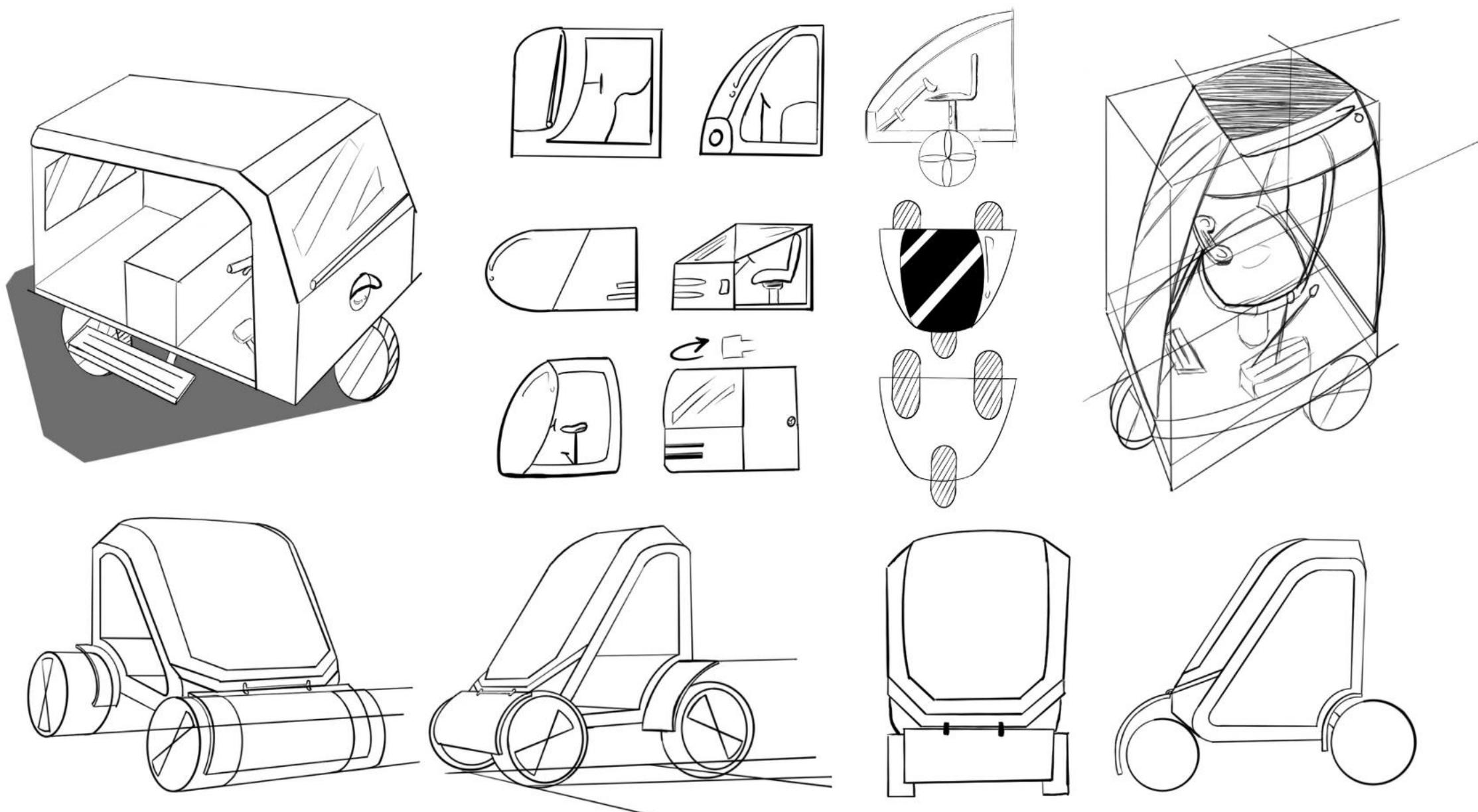
Testbox 1



Testbox 2



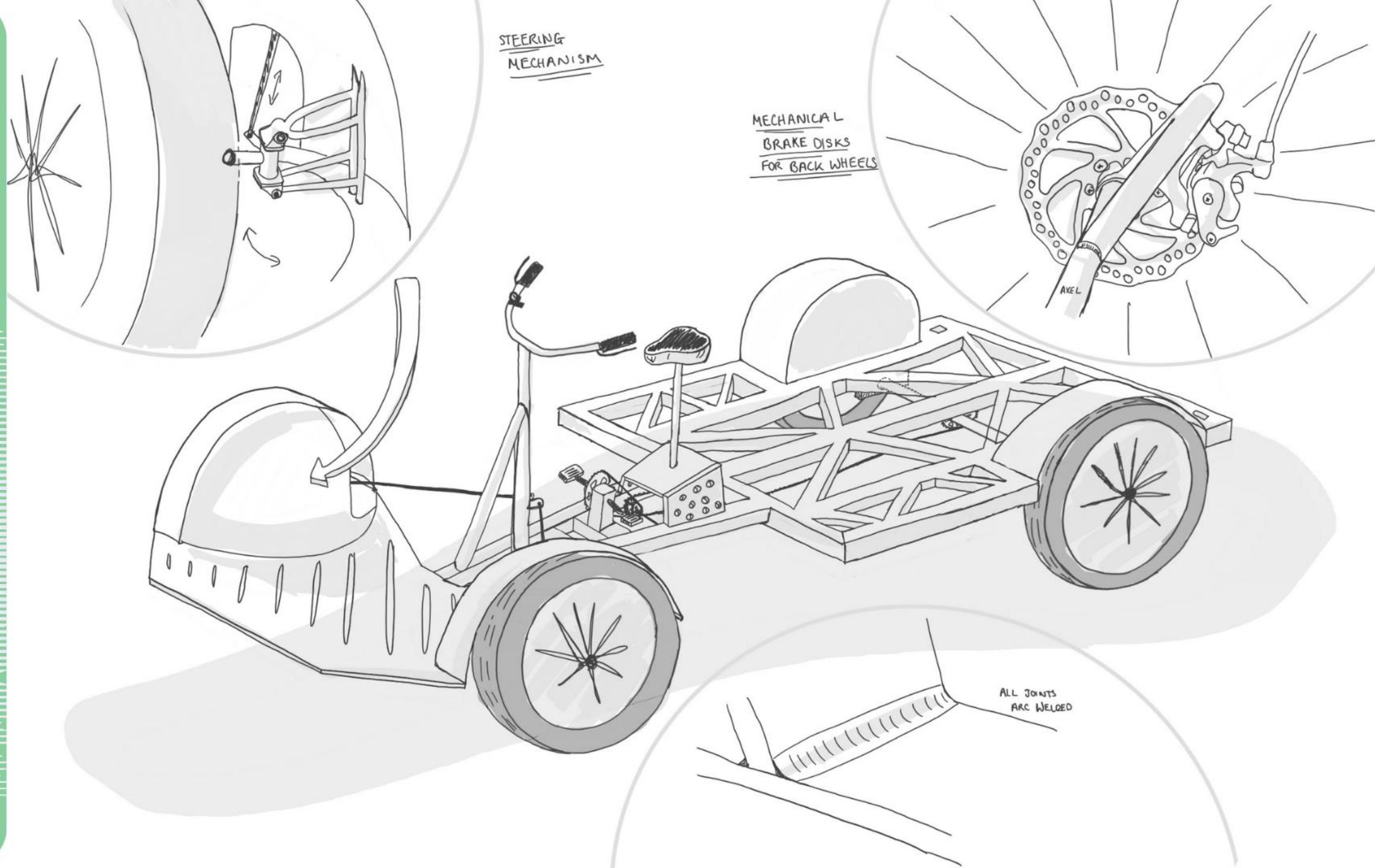
Driving Area



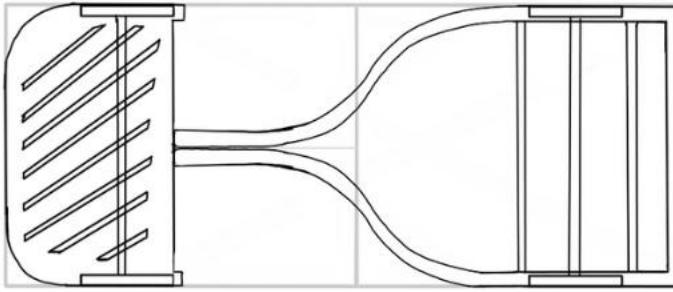
Chassis Design One

Lily Butler

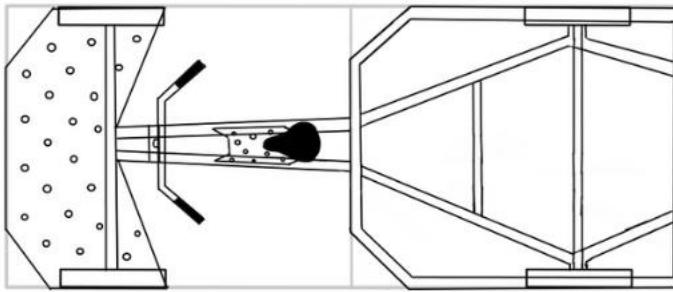
Ideation and
Concept
Development



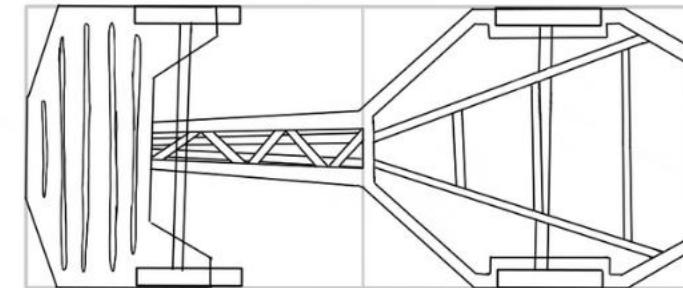
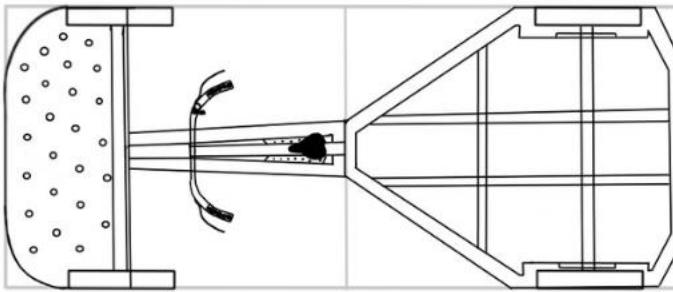
CHASSIS
IDEAS:



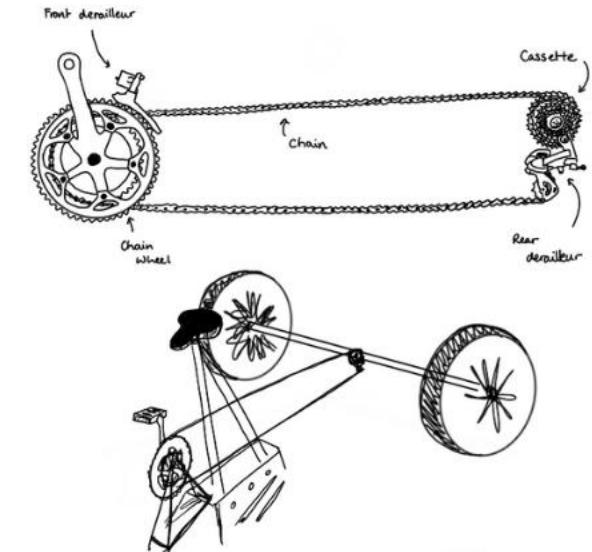
SPACE FOR
PERSONAL
LUGGAGE



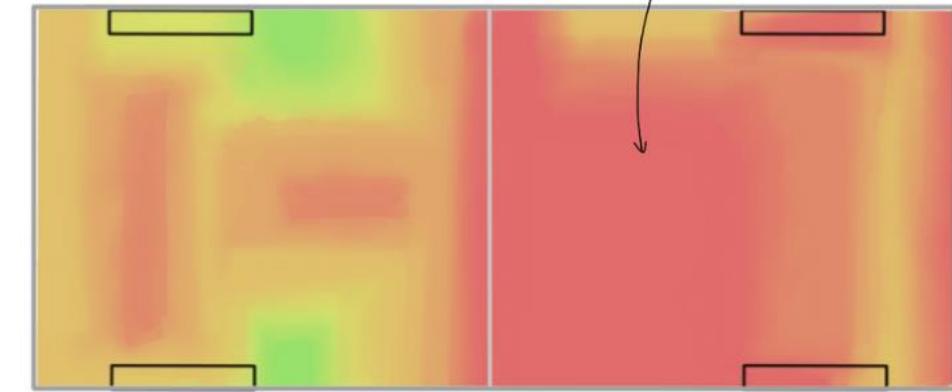
I THINK THAT
THIS DESIGN HAS
THE MOST POTENTIAL.

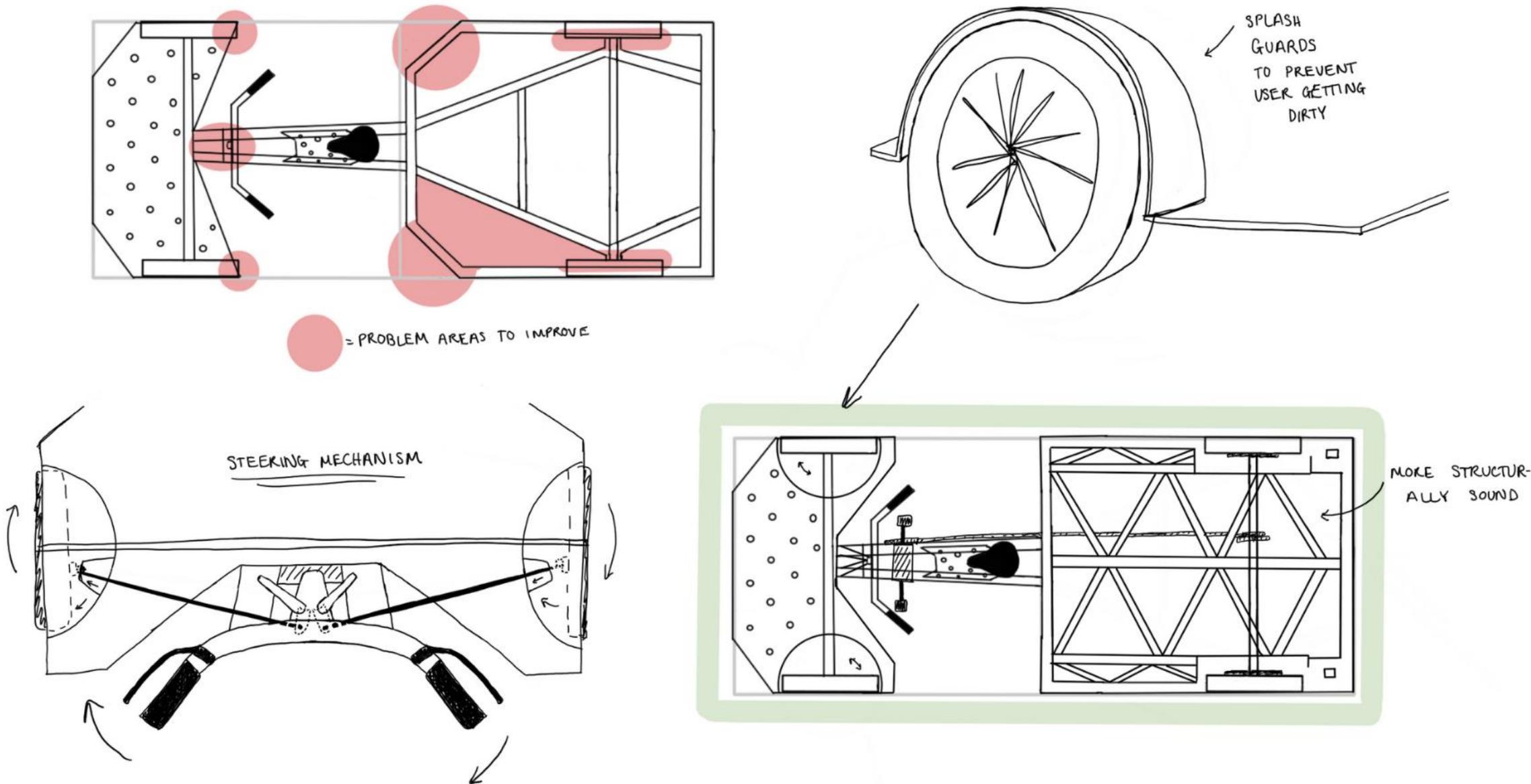


GEAR SYSTEMS:



THIS IS THE AREA THAT THE
PATIENT WILL SIT ON.
THERE NEEDS TO BE
SUFFICIENT SUPPORT IN
THE FRAME TO COPE
WITH THIS.

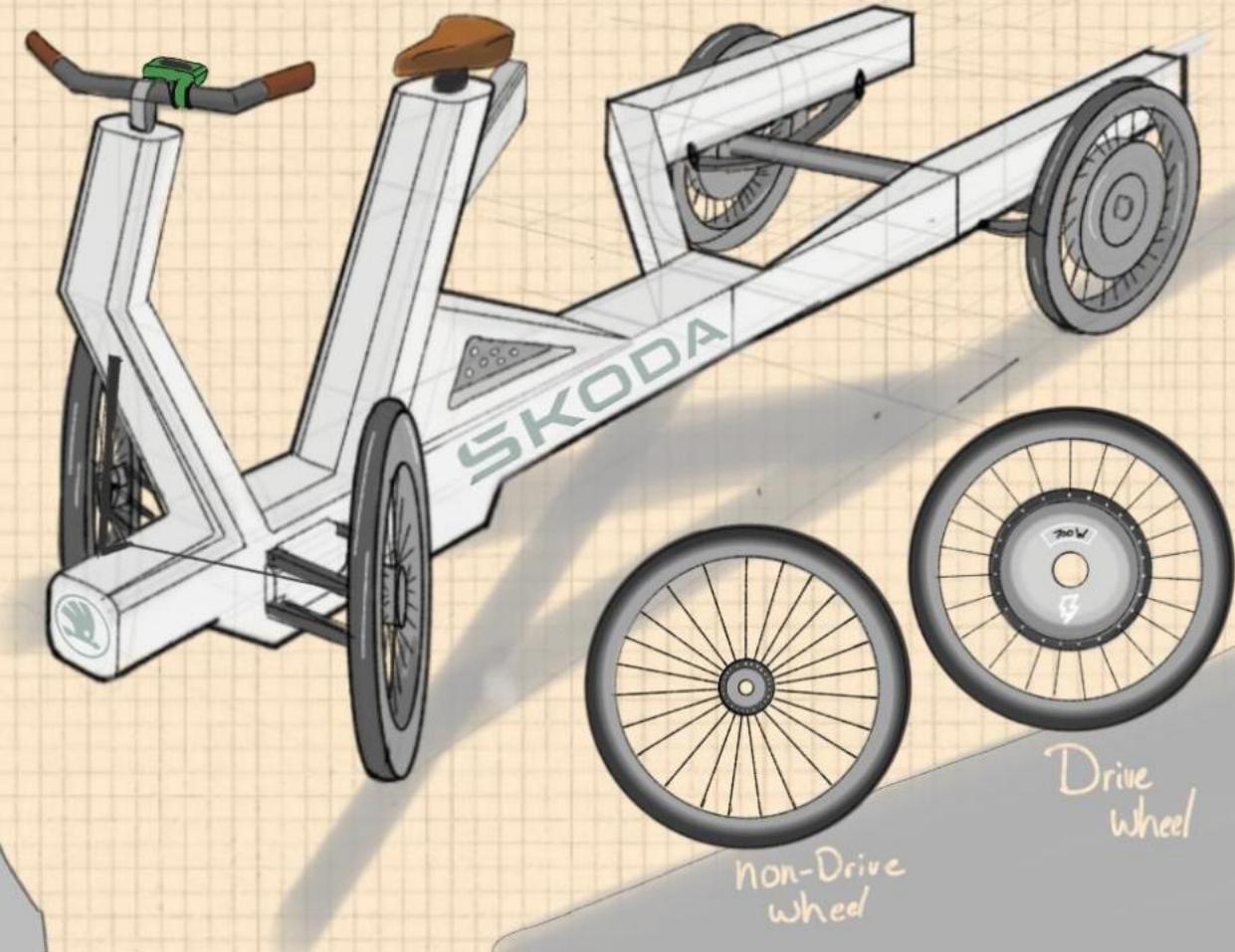
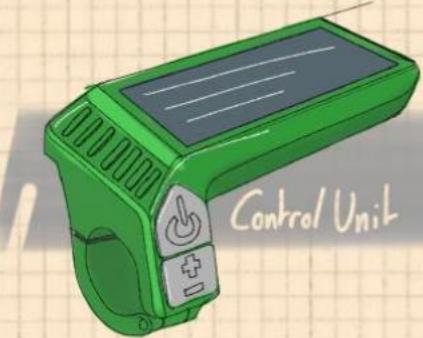
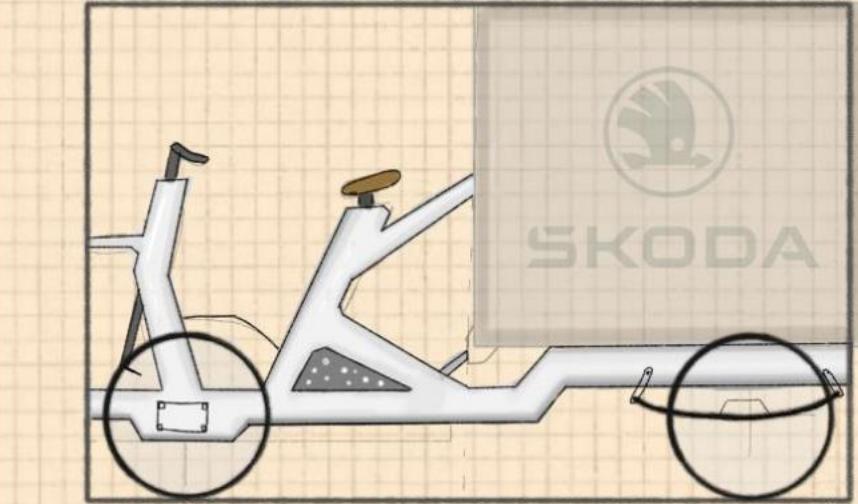
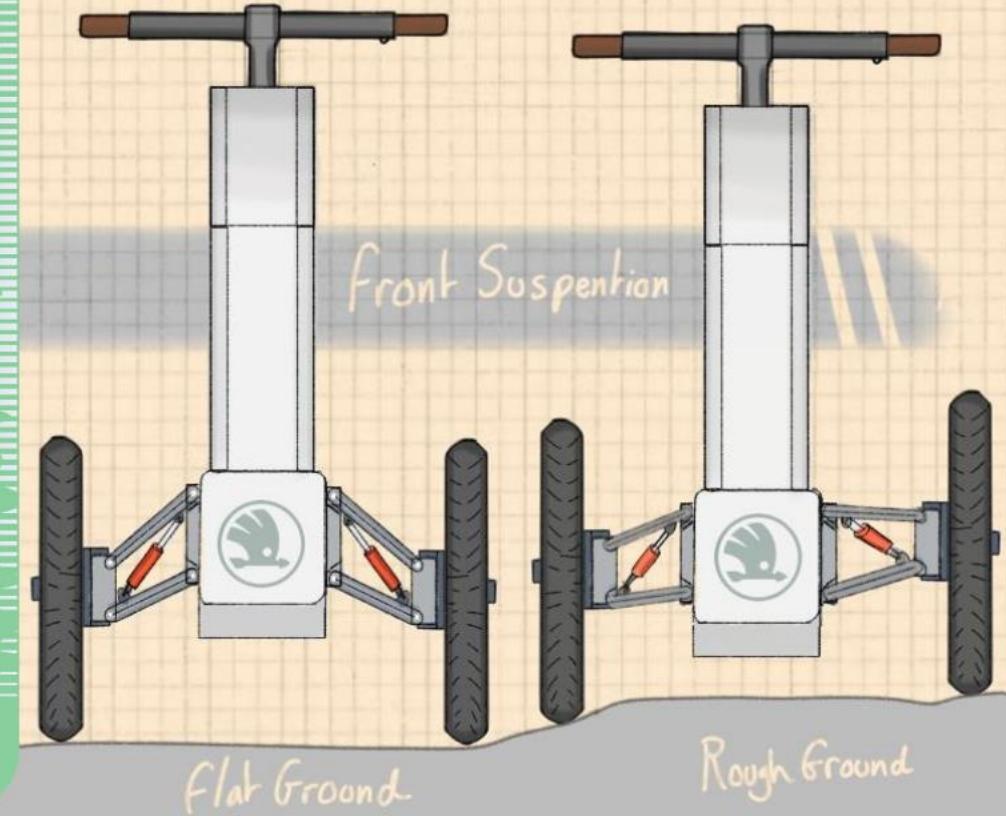


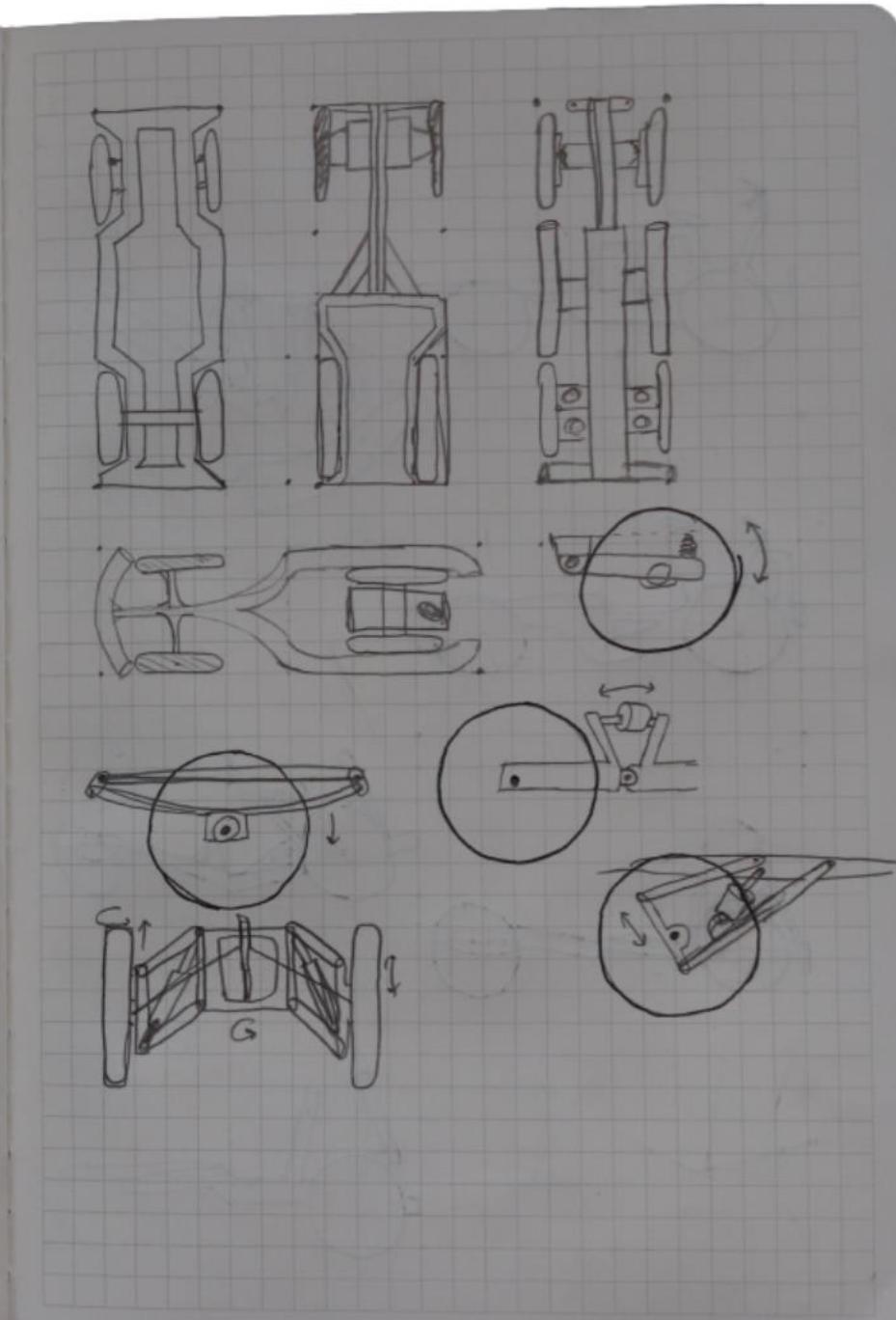
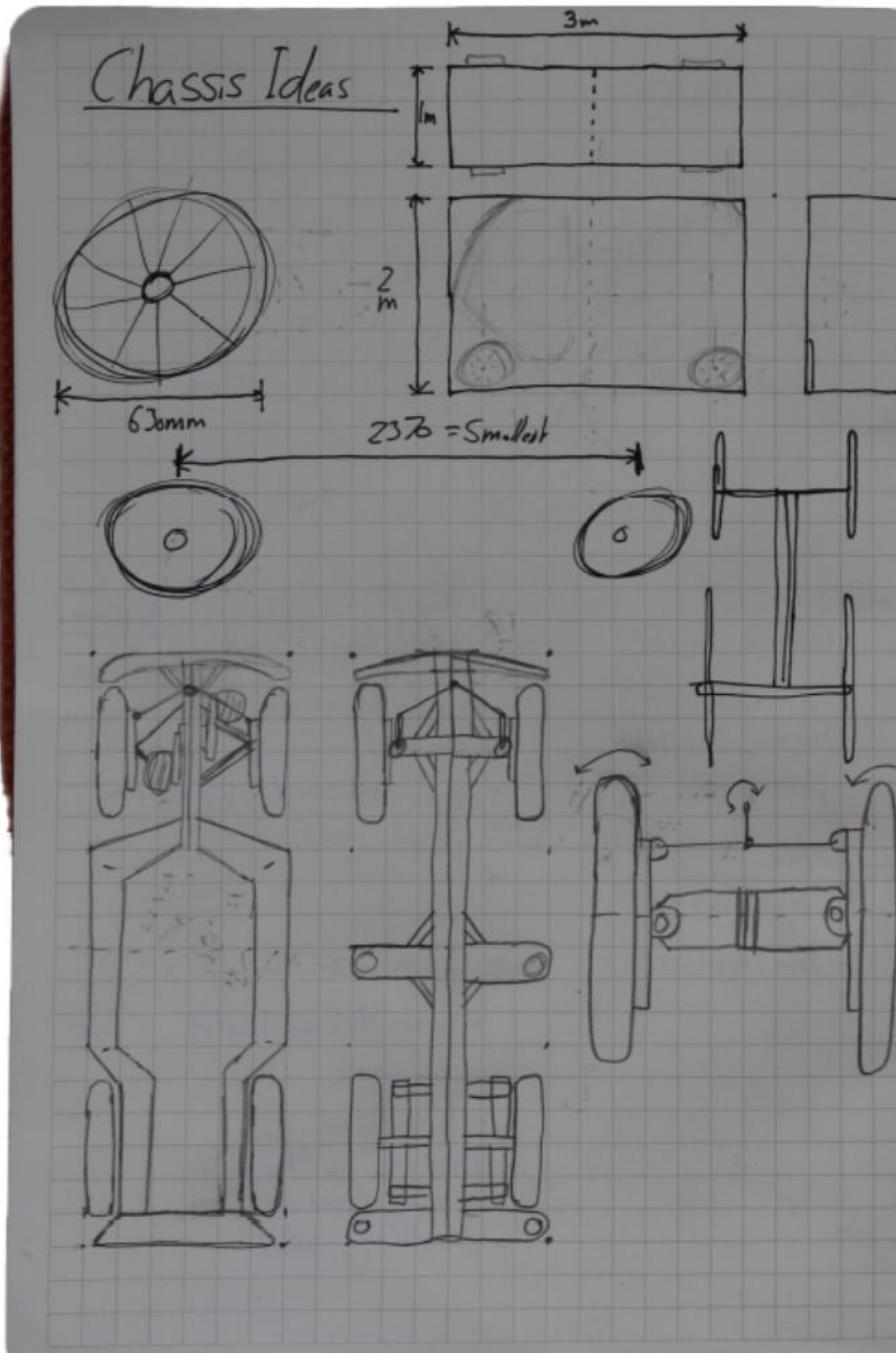


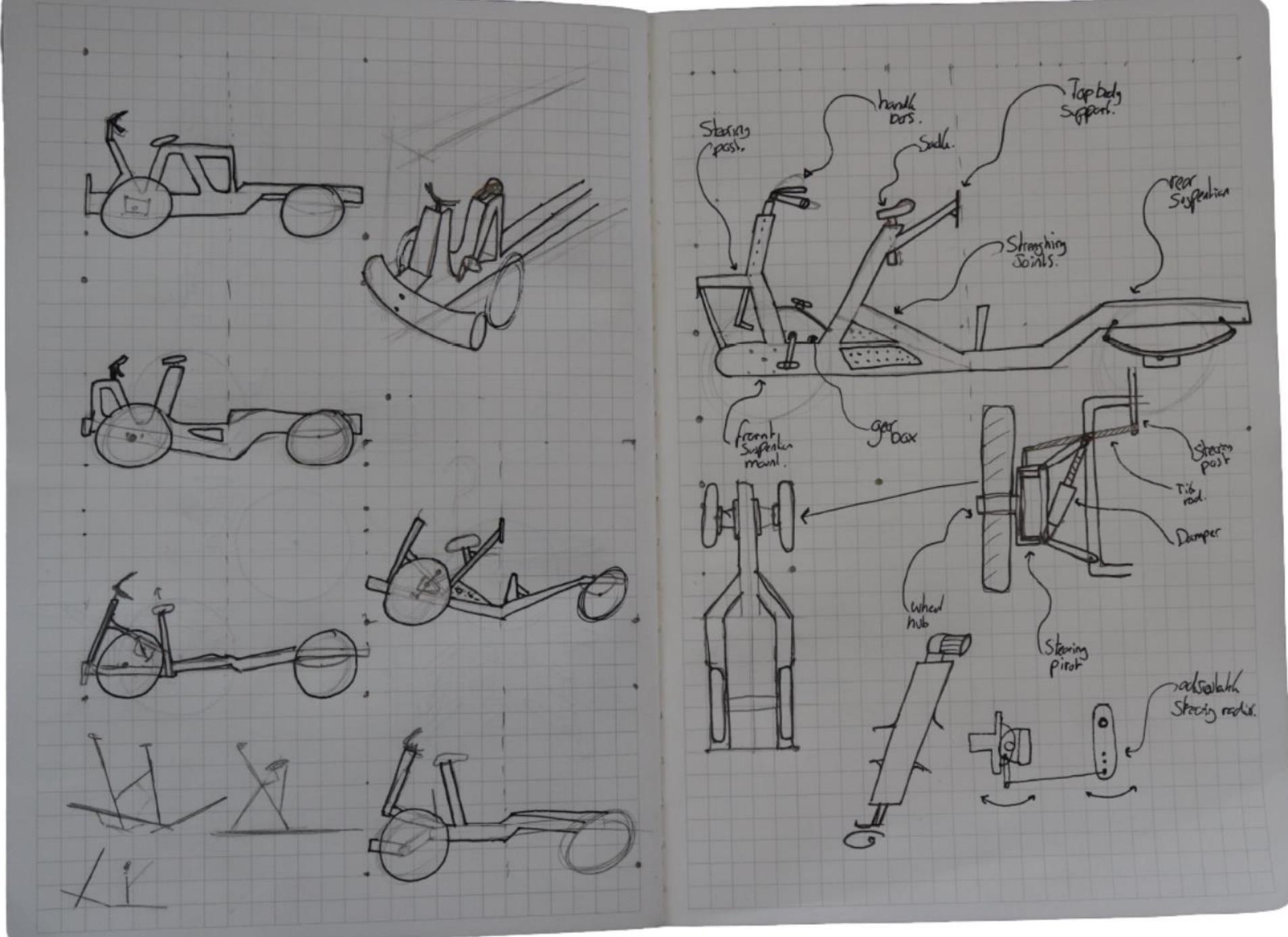
Chassis Design Two

Dom Brown

Ideation and
Concept
Development

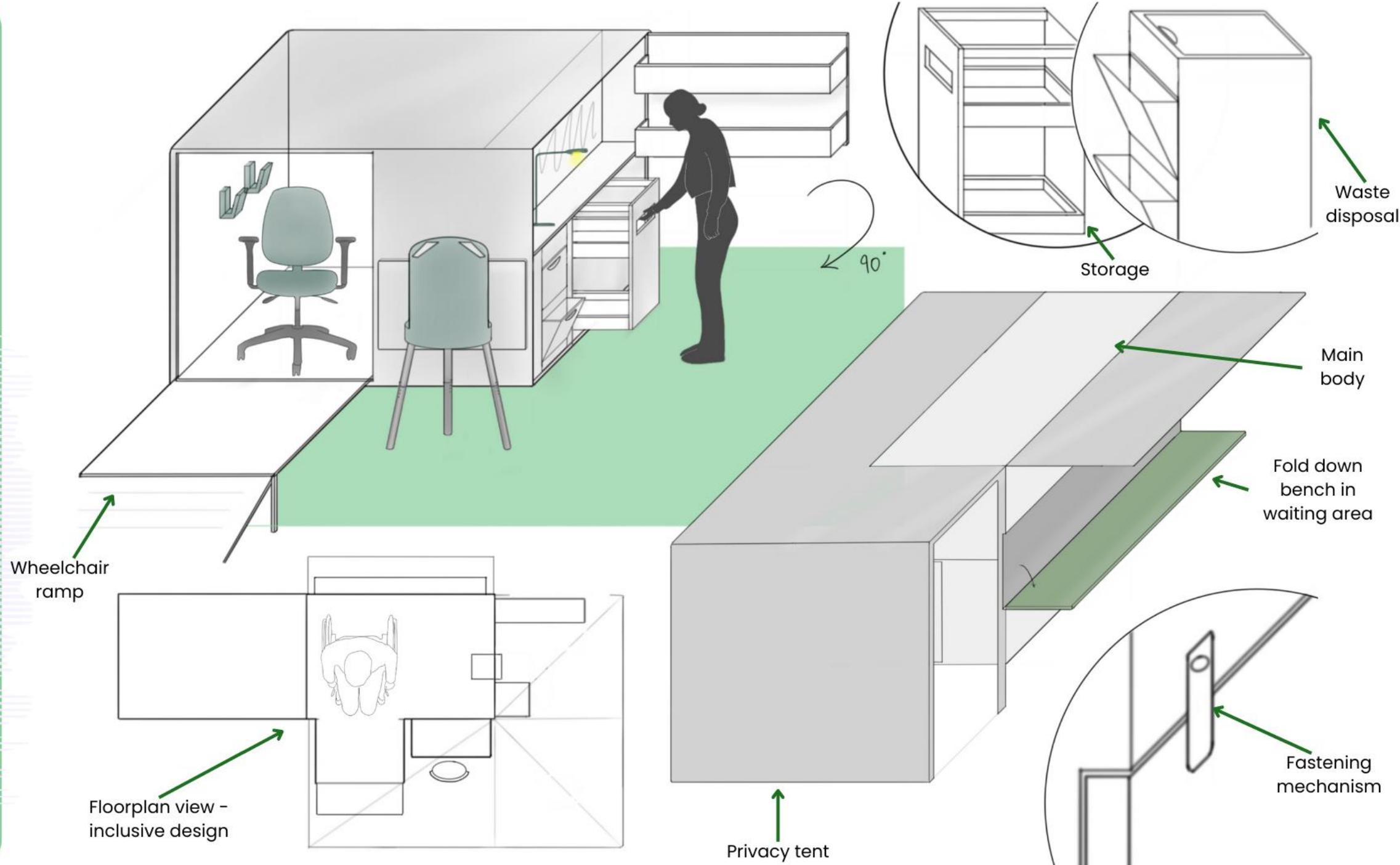






Medical Service Design One

Ideation and
Concept
Development

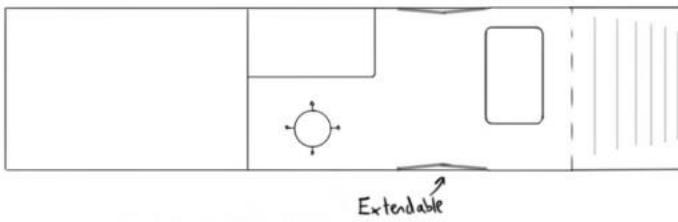
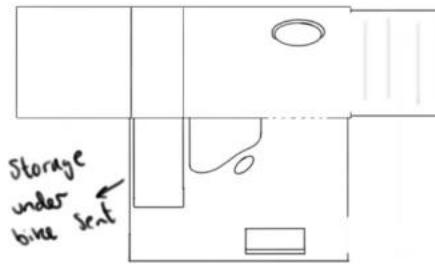
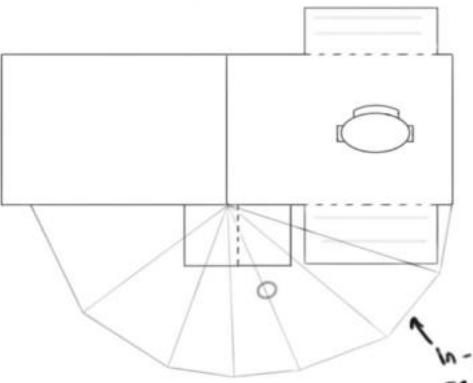
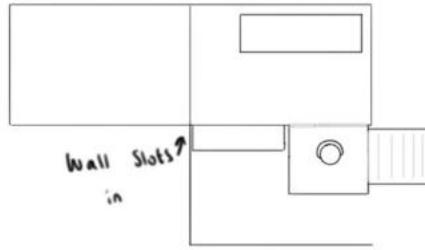
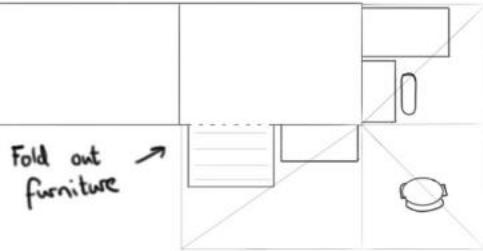


Moodboard

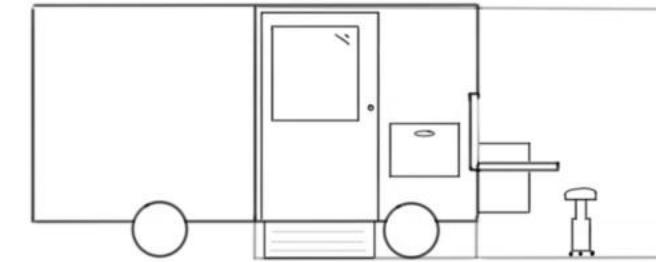
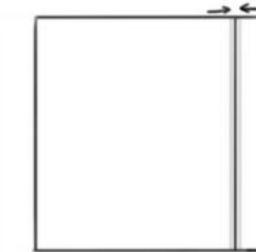
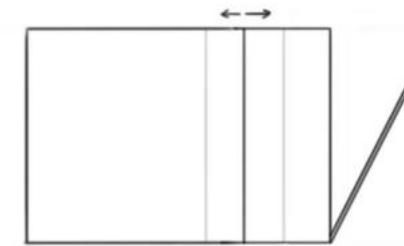
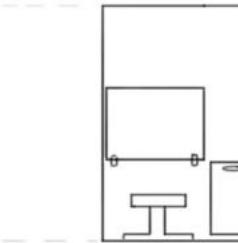
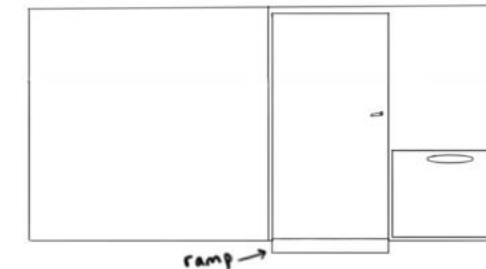


Appendix Two

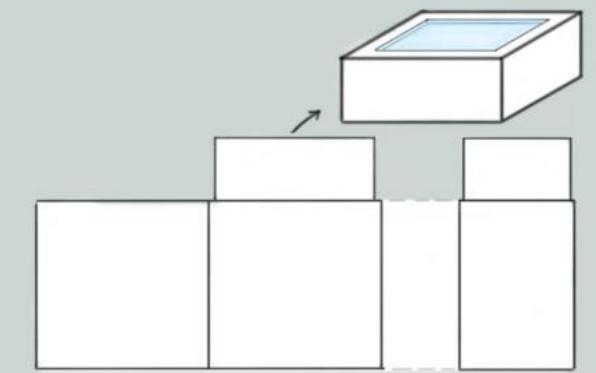
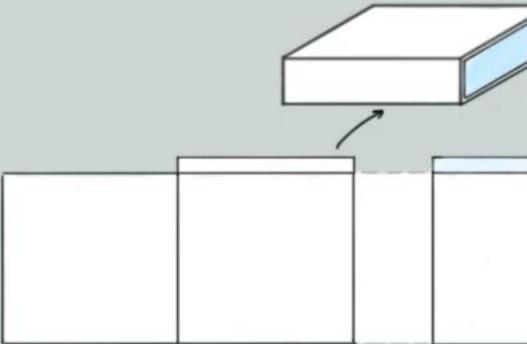
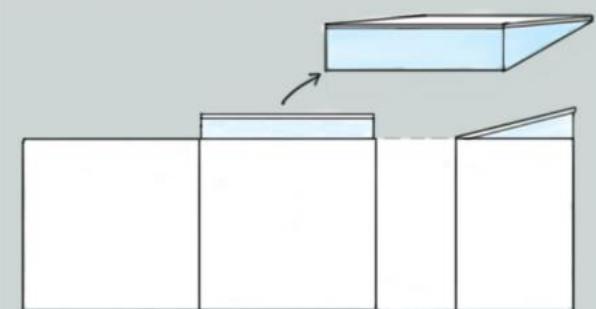
Floor Plans



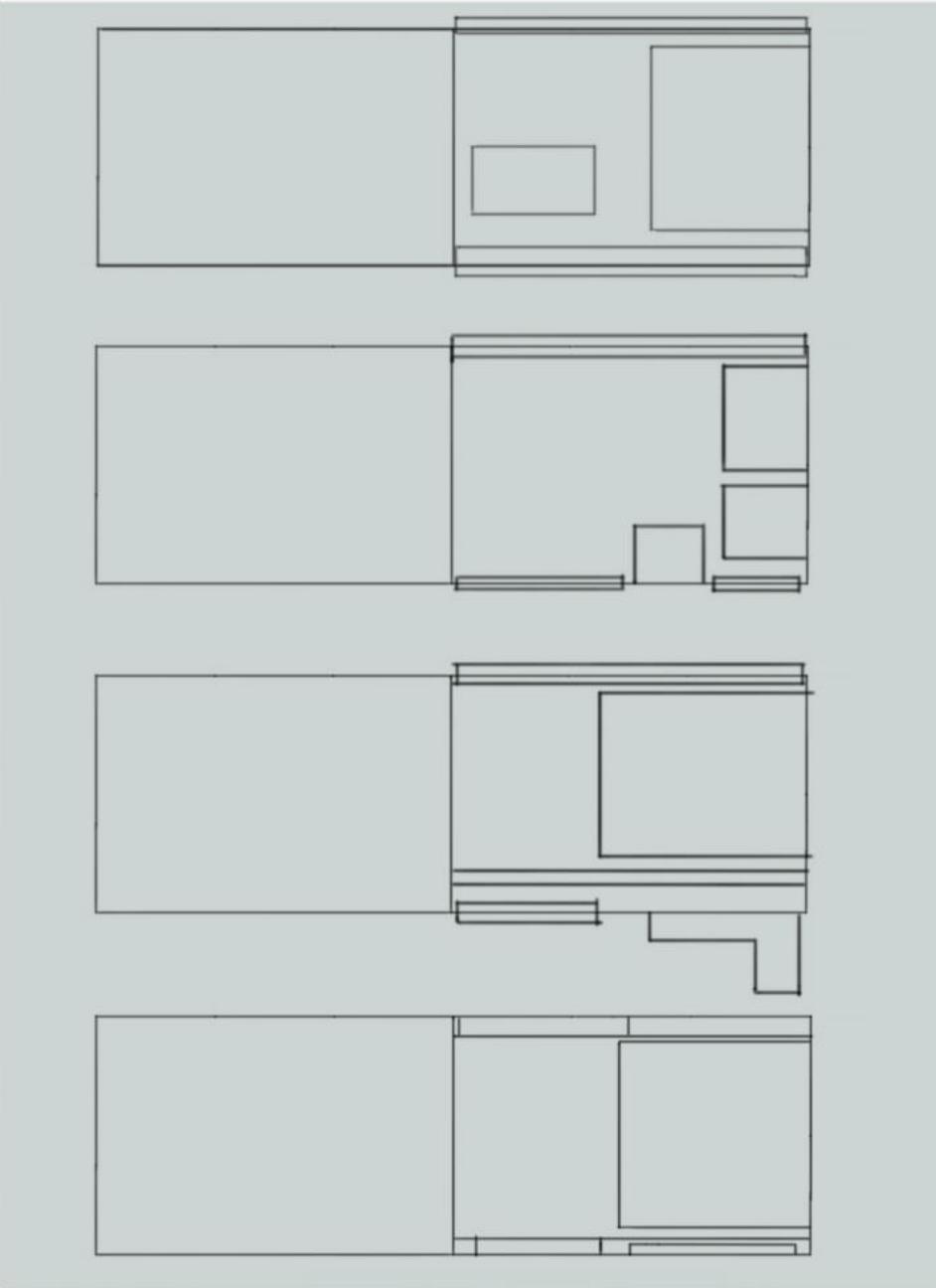
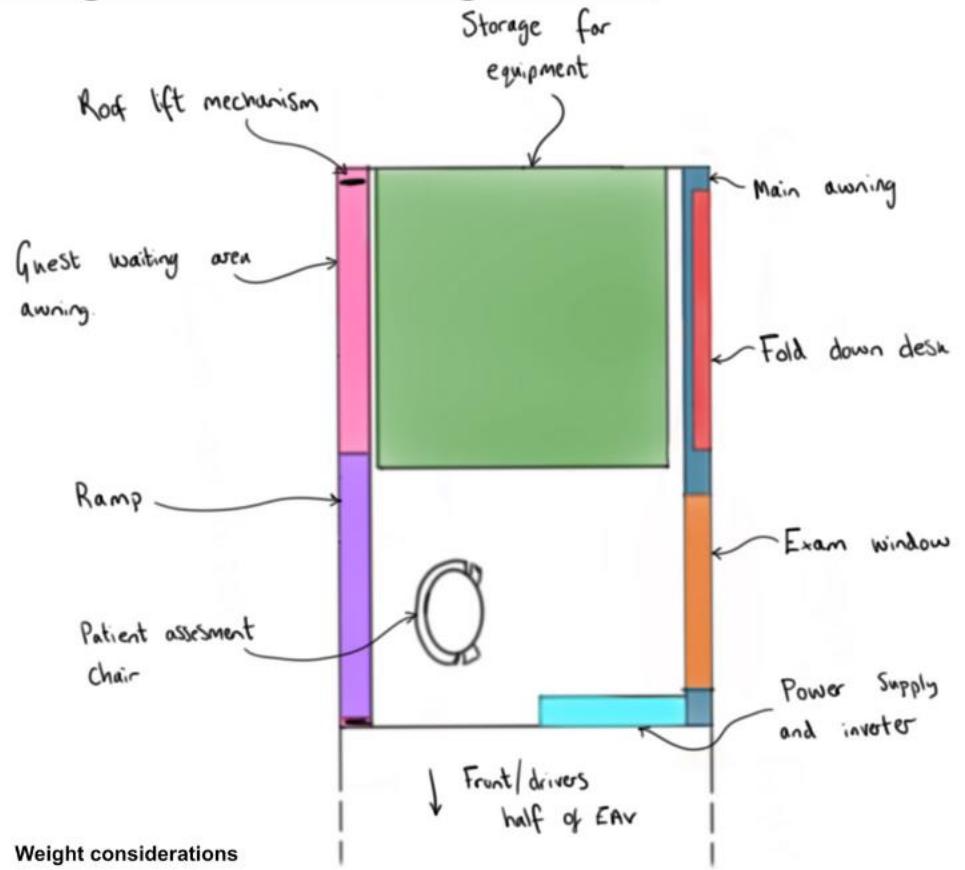
Side Views



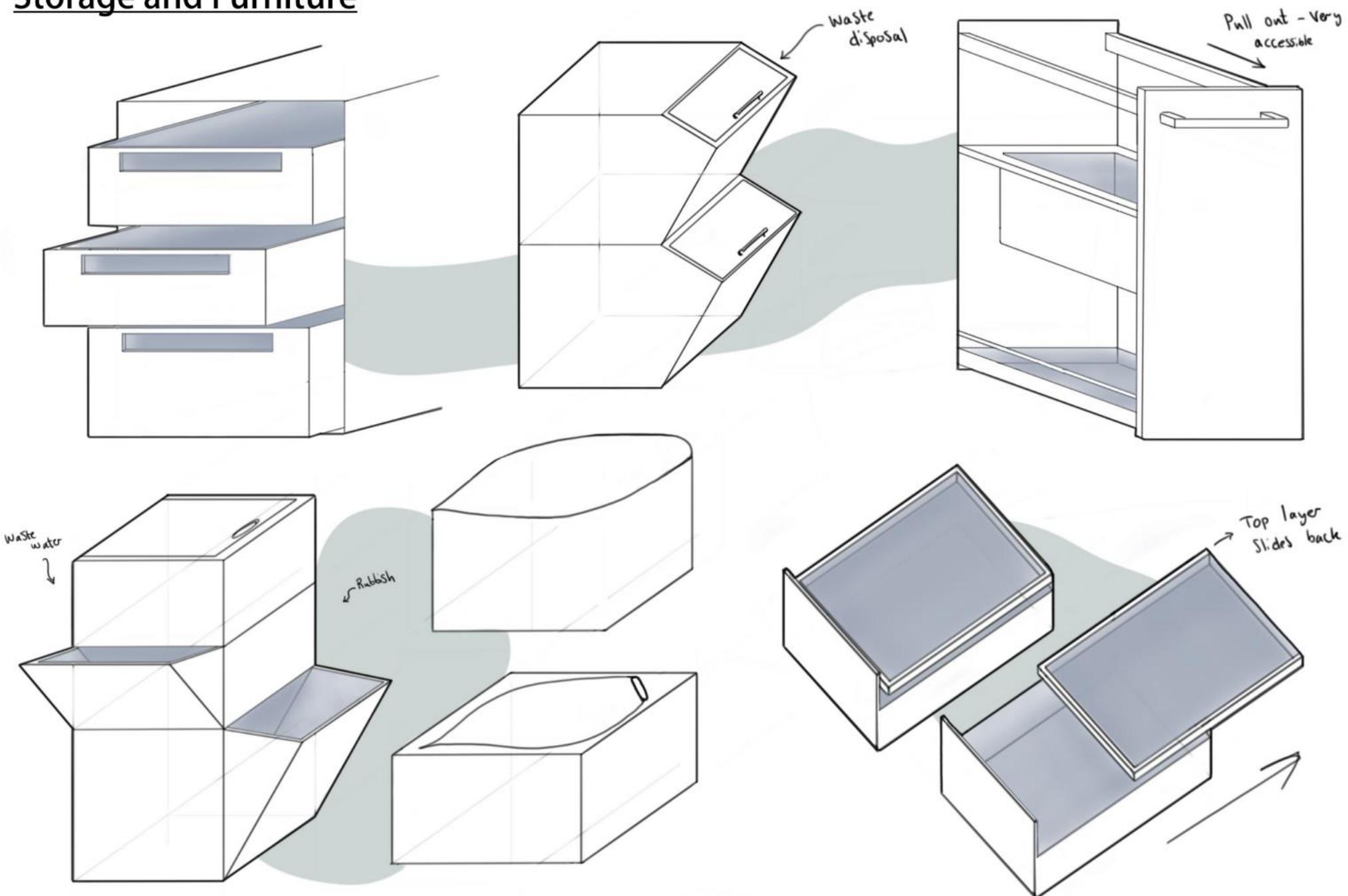
Roof Ideas



Weight and Arrangement

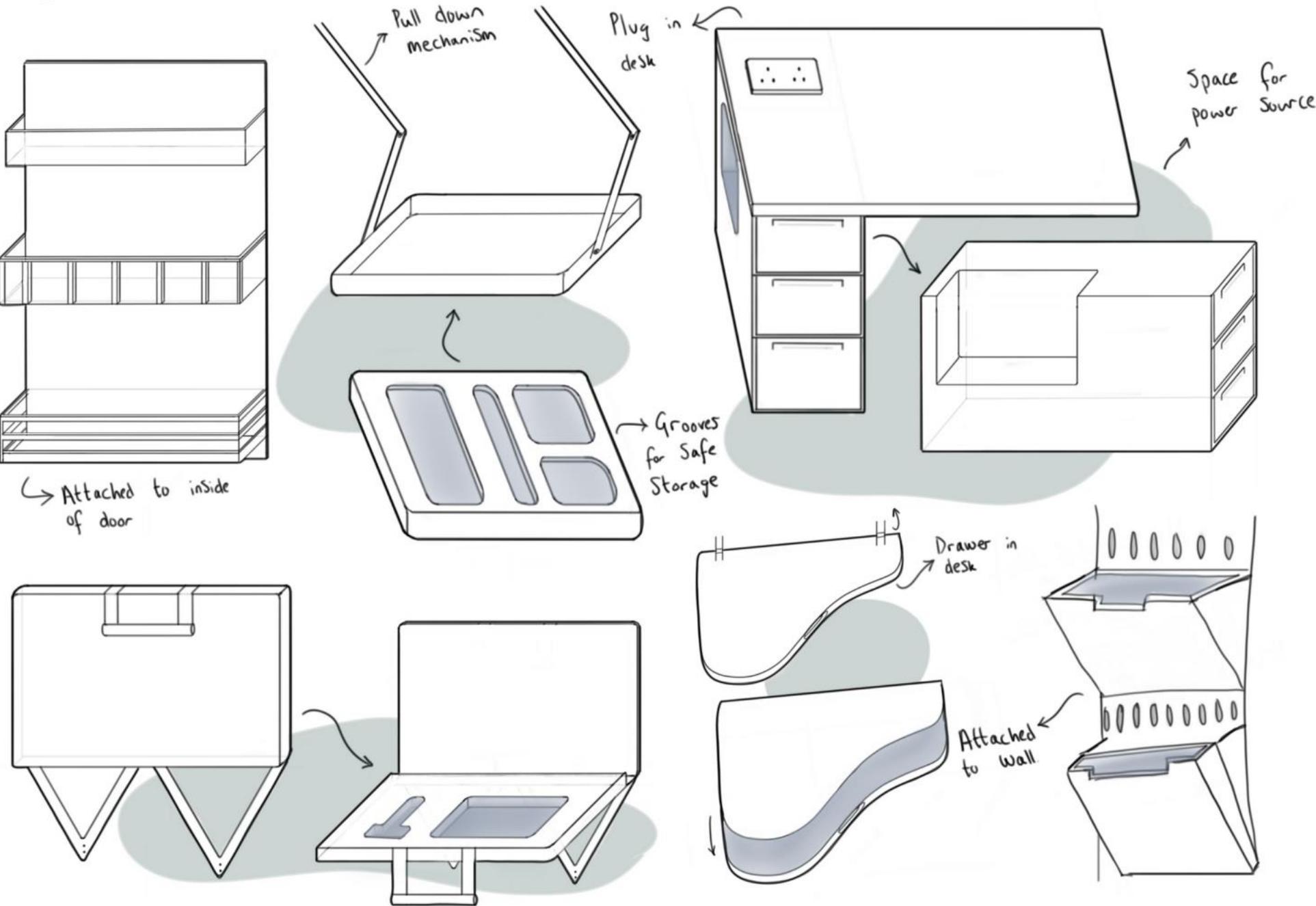


Storage and Furniture

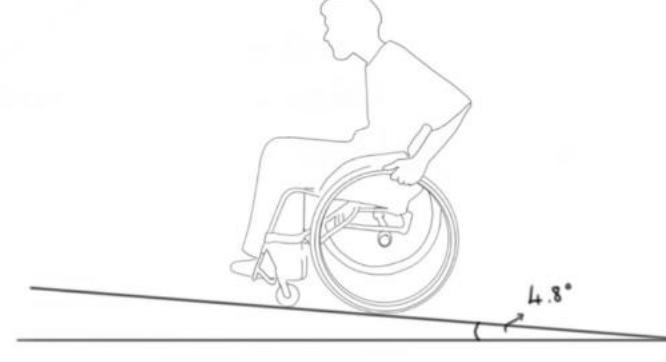
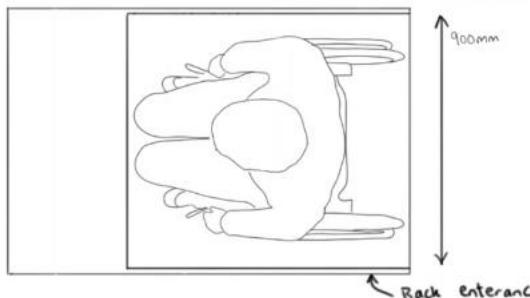
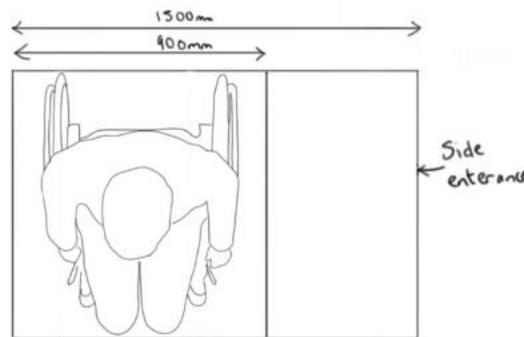
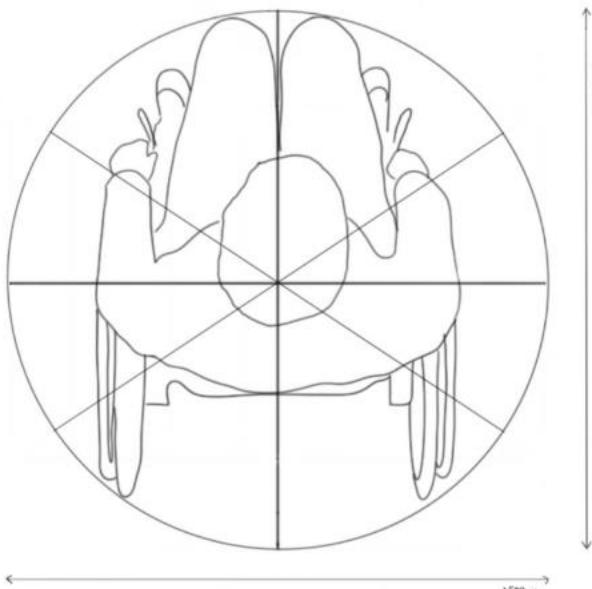


Appendix Five

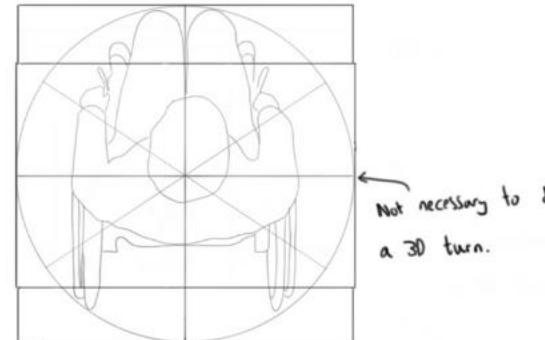
Storage and Furniture Cont.



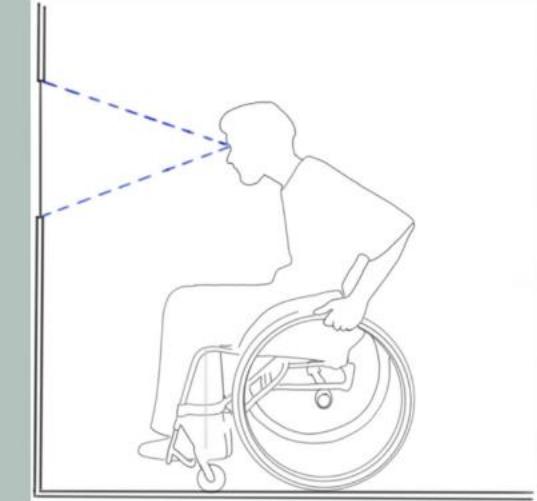
Usability and Inclusivity



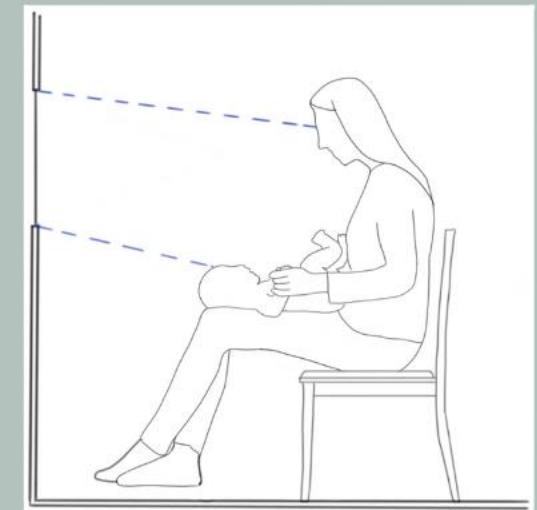
The rise for the wheelchair ramp should be a maximum of 150mm.



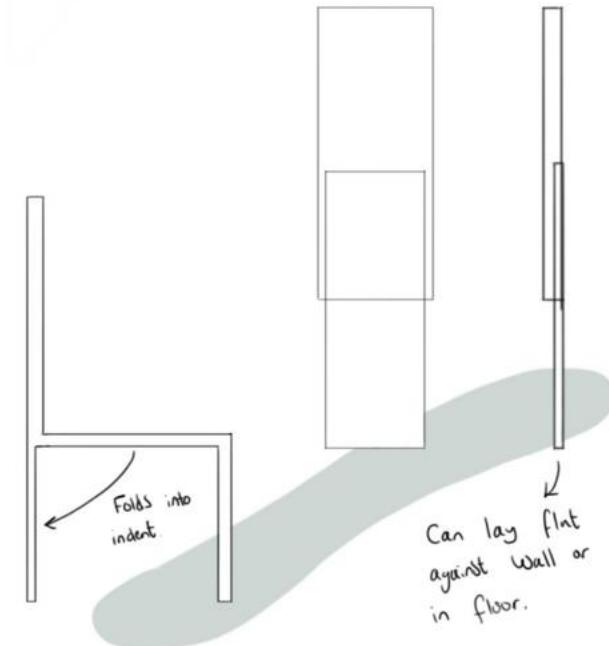
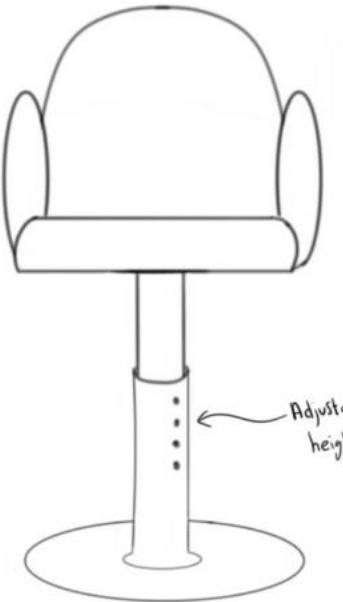
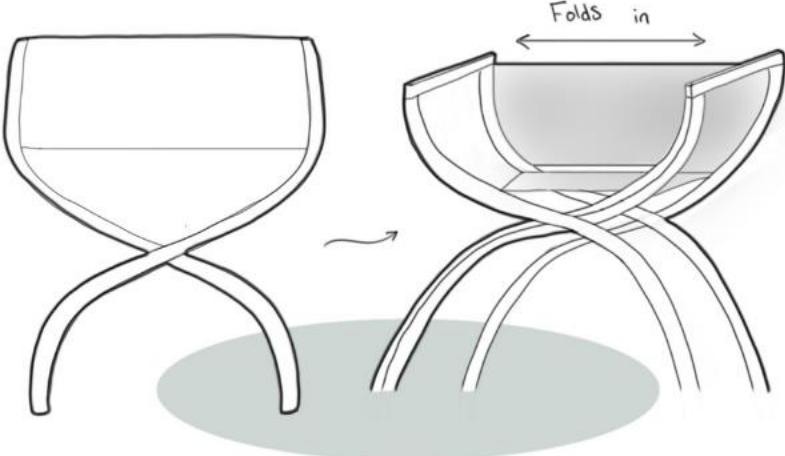
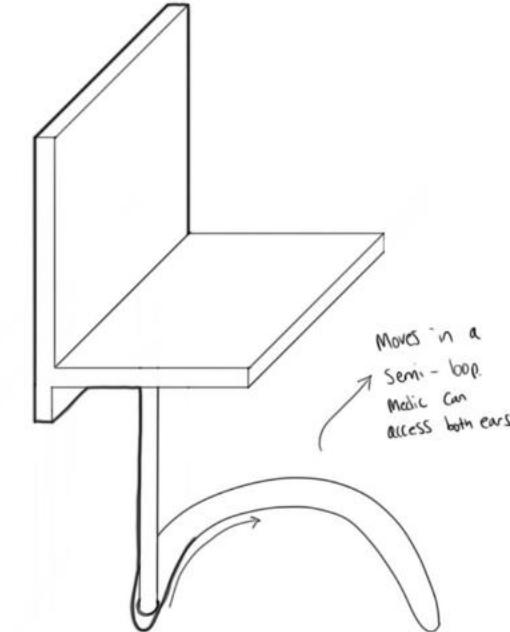
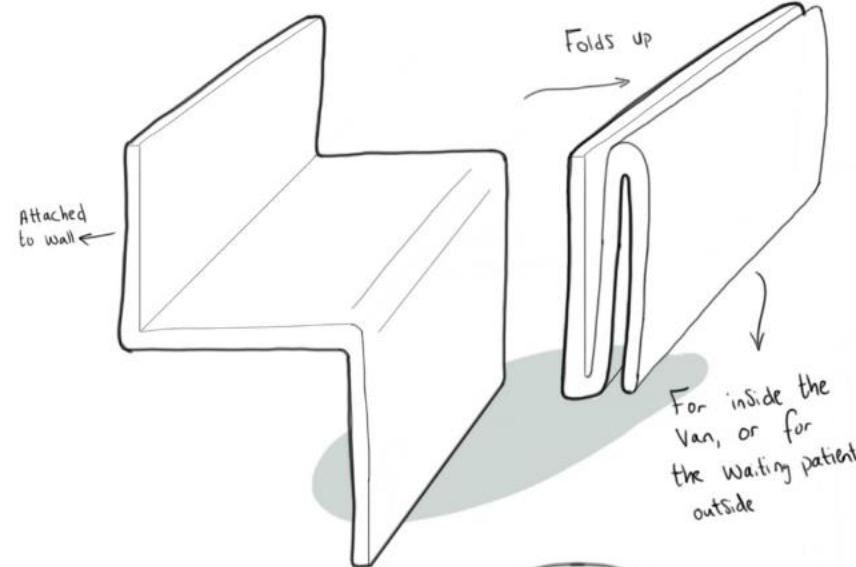
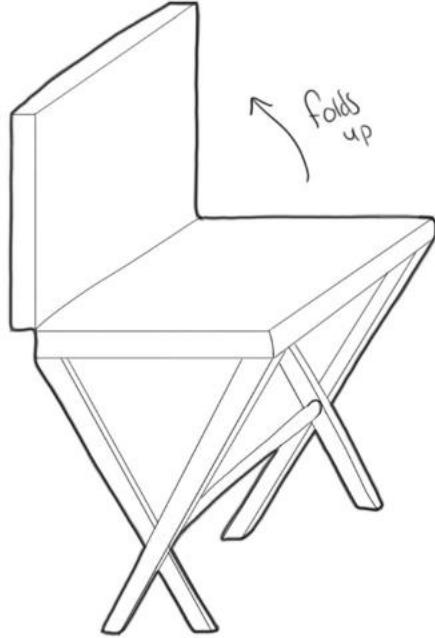
For the door frame there has to be a width of at least 840mm, but preferably this would be 900mm wide, to allow for the user to comfortably access the wheels.



It is important for the medic to be able to see the patient when they're in the soundproof room. Whether this be a person using a wheelchair, or a baby on their parents lap.



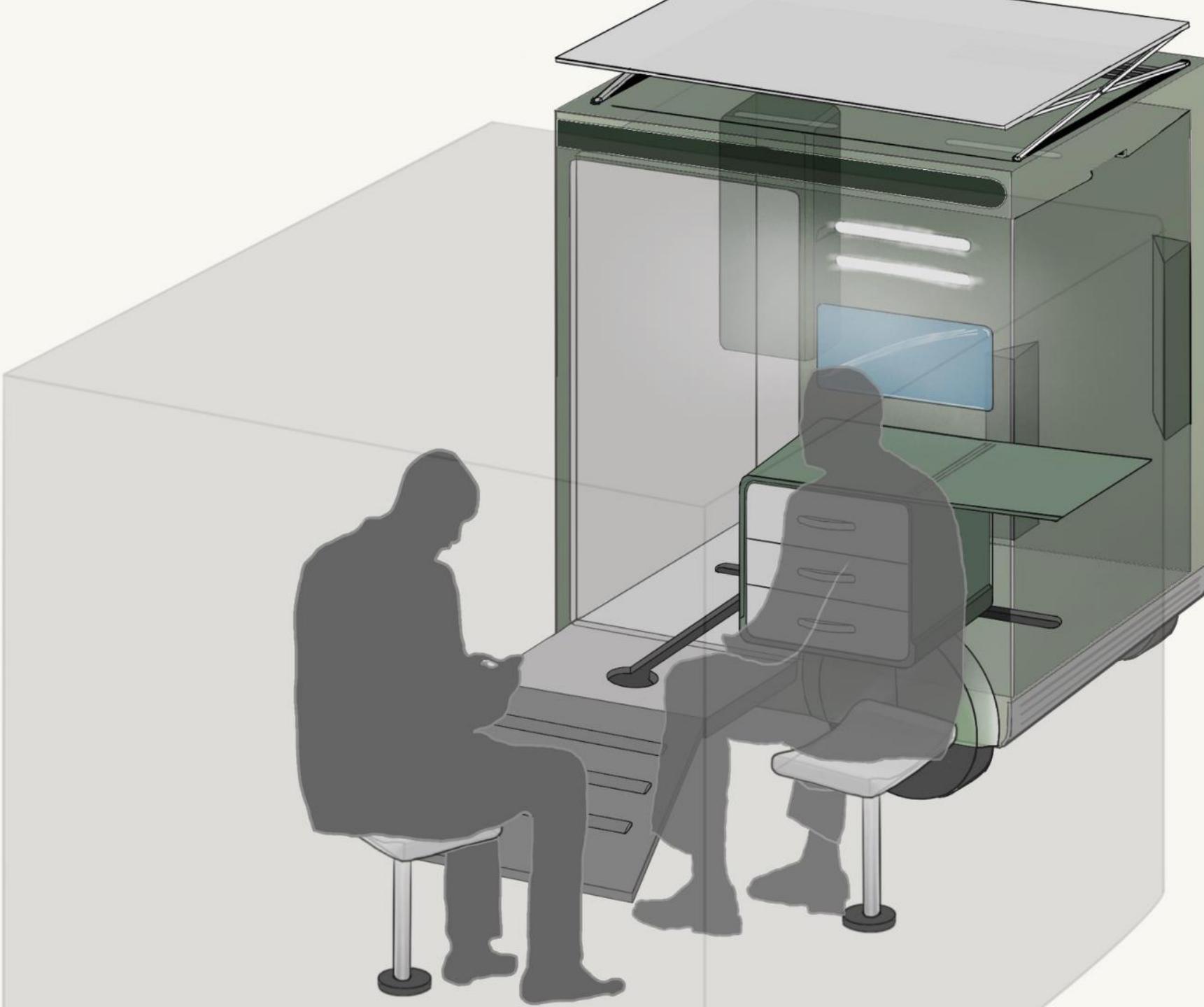
Chair Design



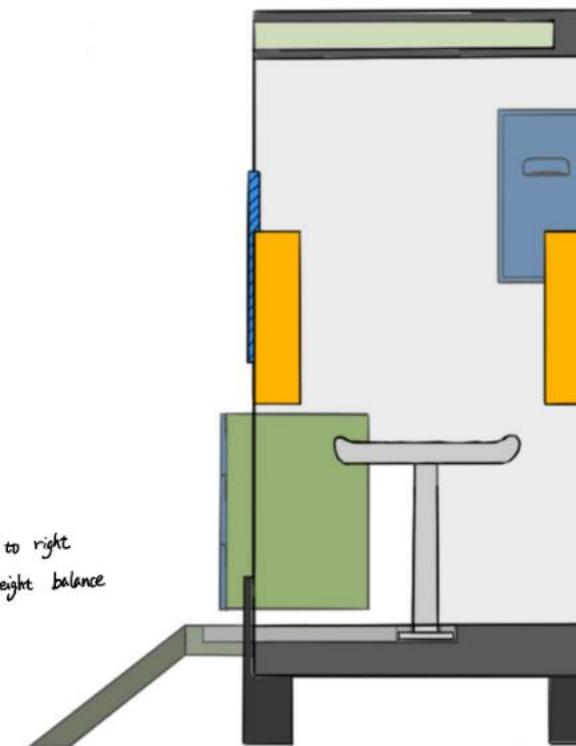
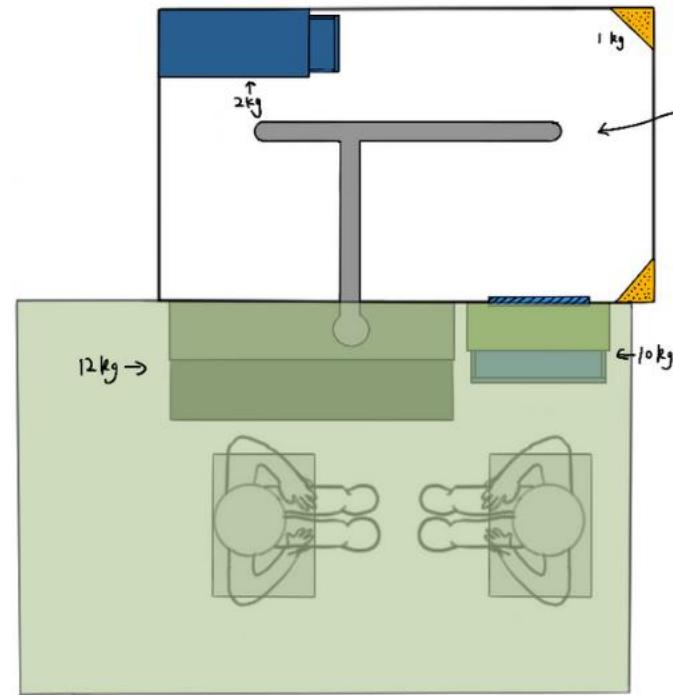
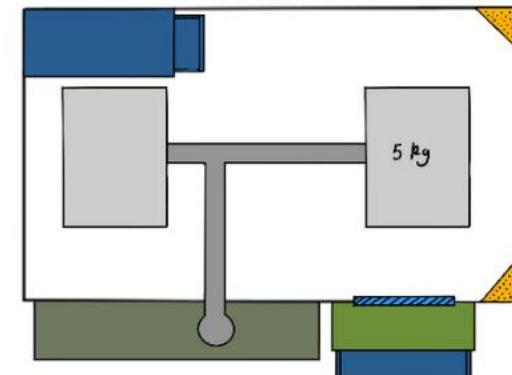
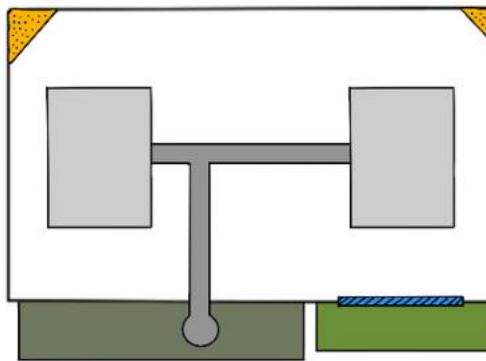
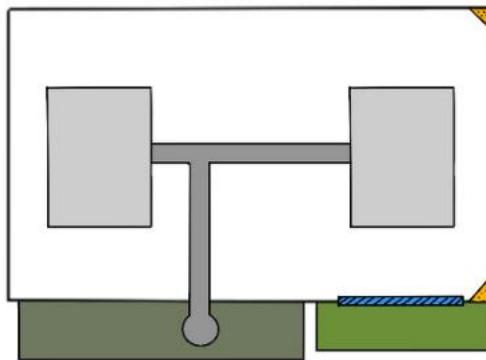
Medical Service Design Two

Qicheng Liu

Ideation and
Concept
Development

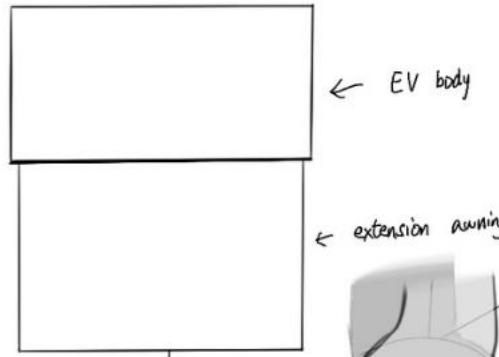


Layout & weight balance ideation

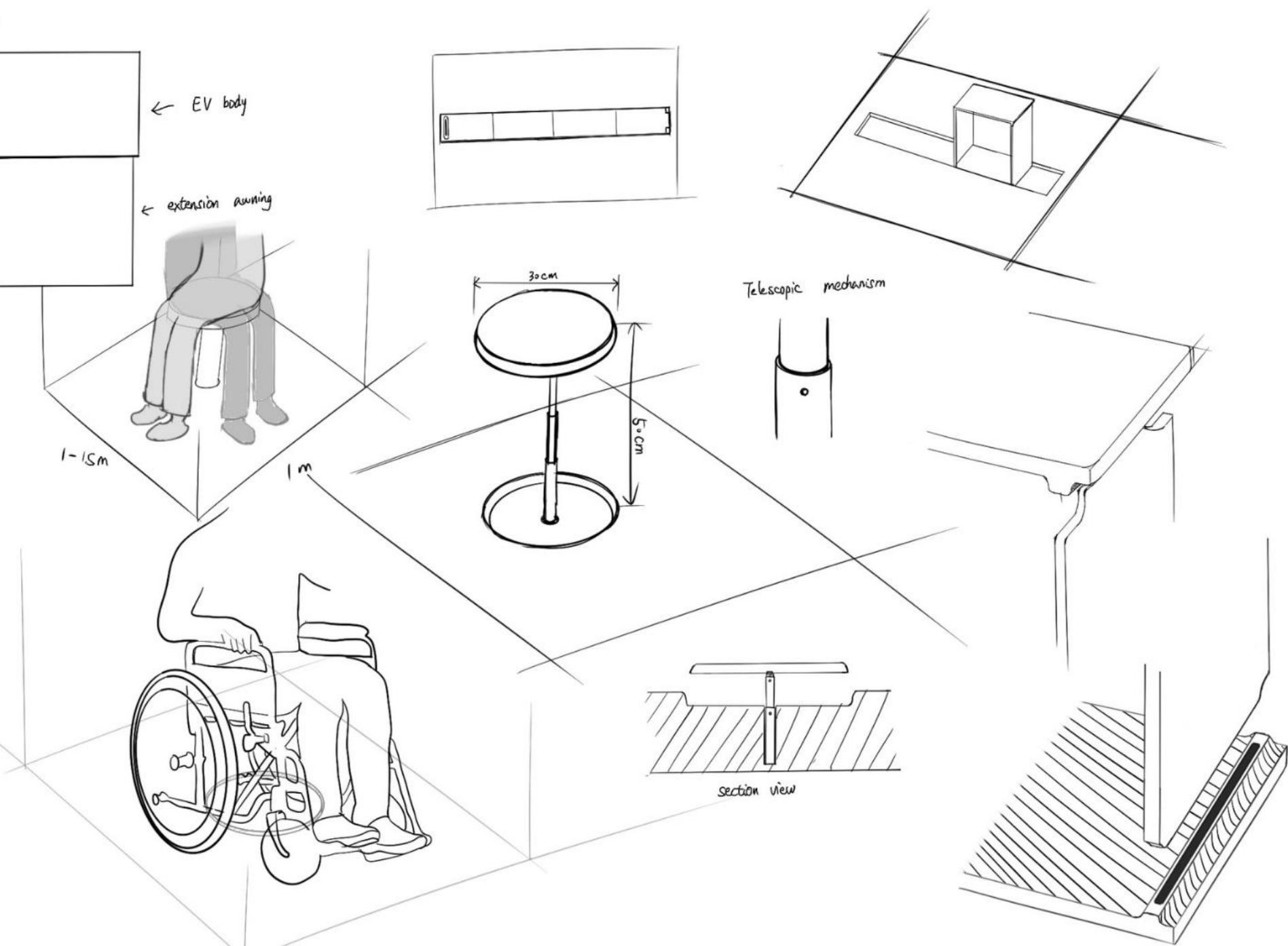


- | | |
|----------|---------|
| chair | window |
| track | speaker |
| desk | storage |
| footstep | awning |
- ramp

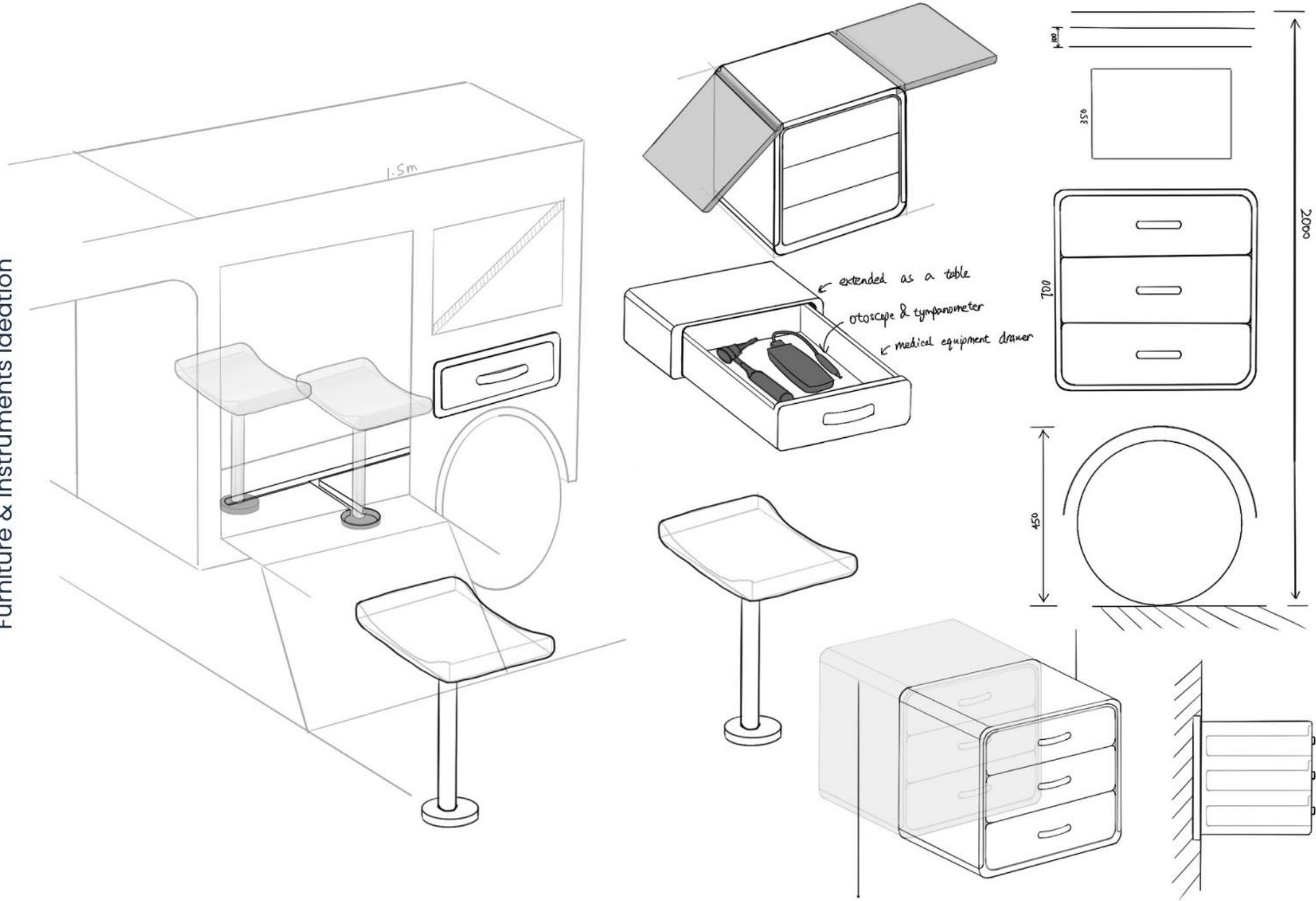
Design area



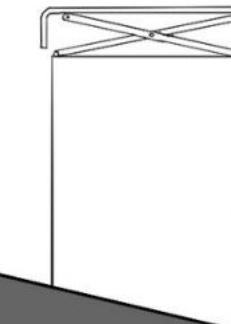
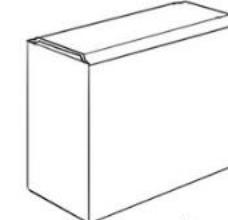
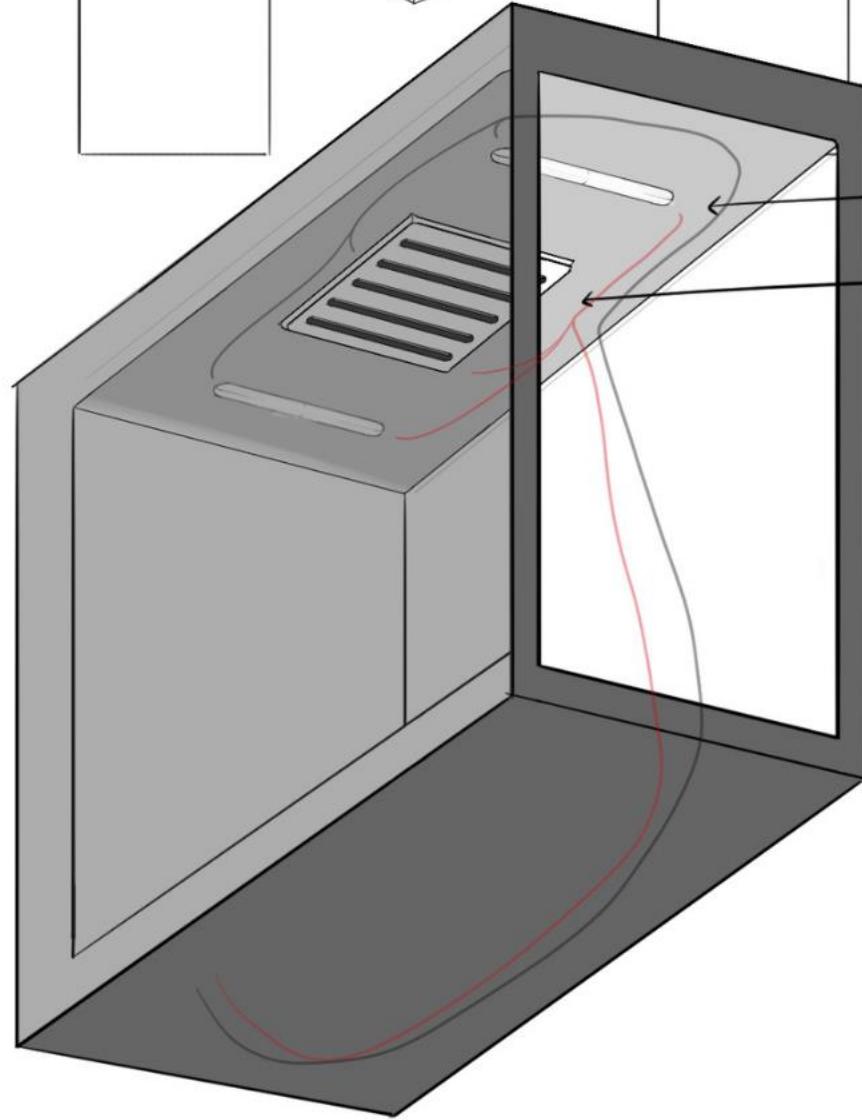
Furniture ideation



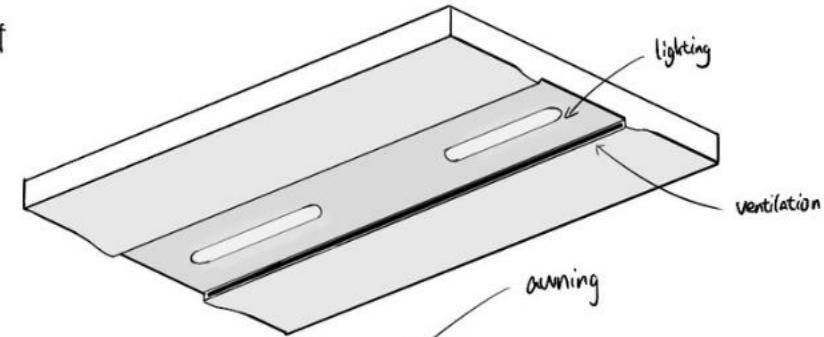
Furniture & instruments ideation



Equipment ideation

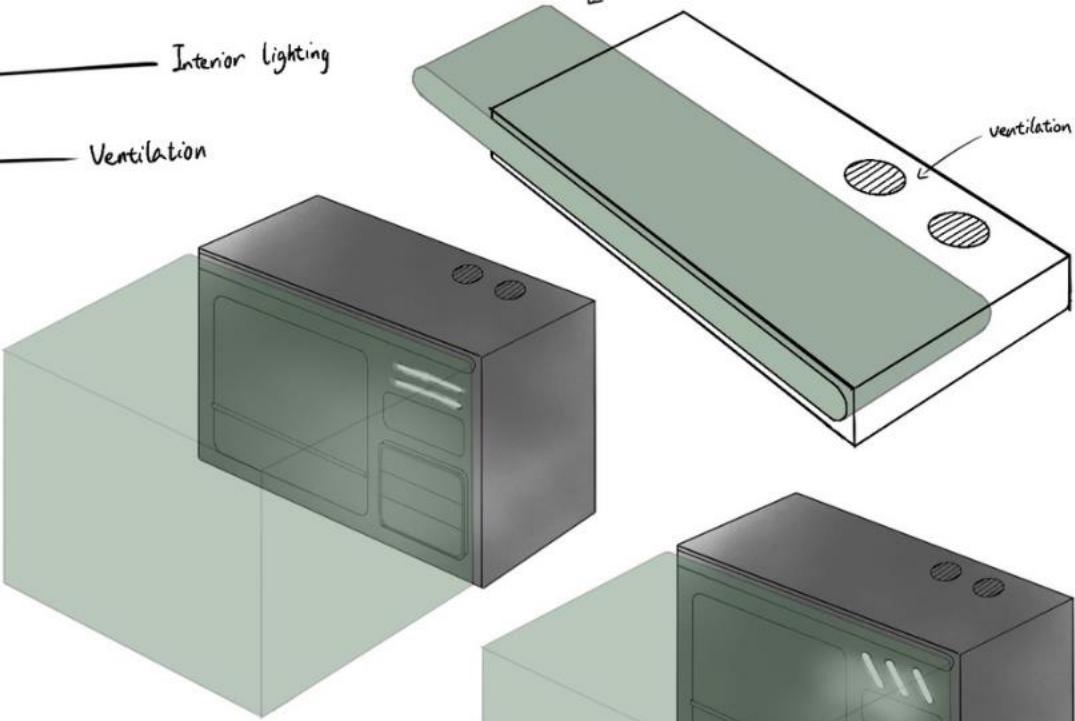


extra isolation of
rain noise

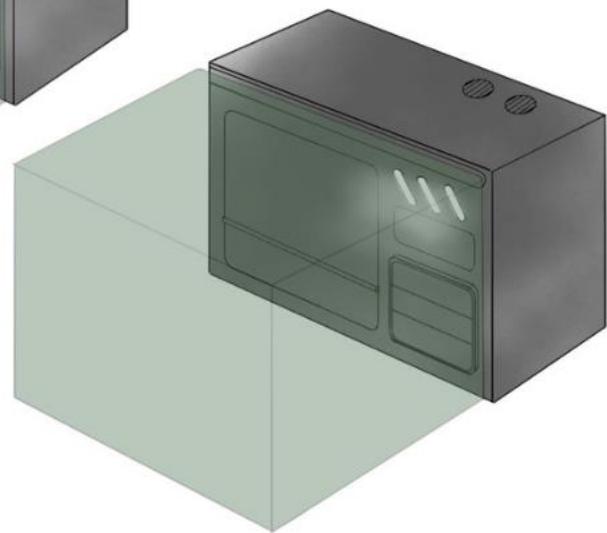


Interior lighting

Ventilation



lighting for exterior test space



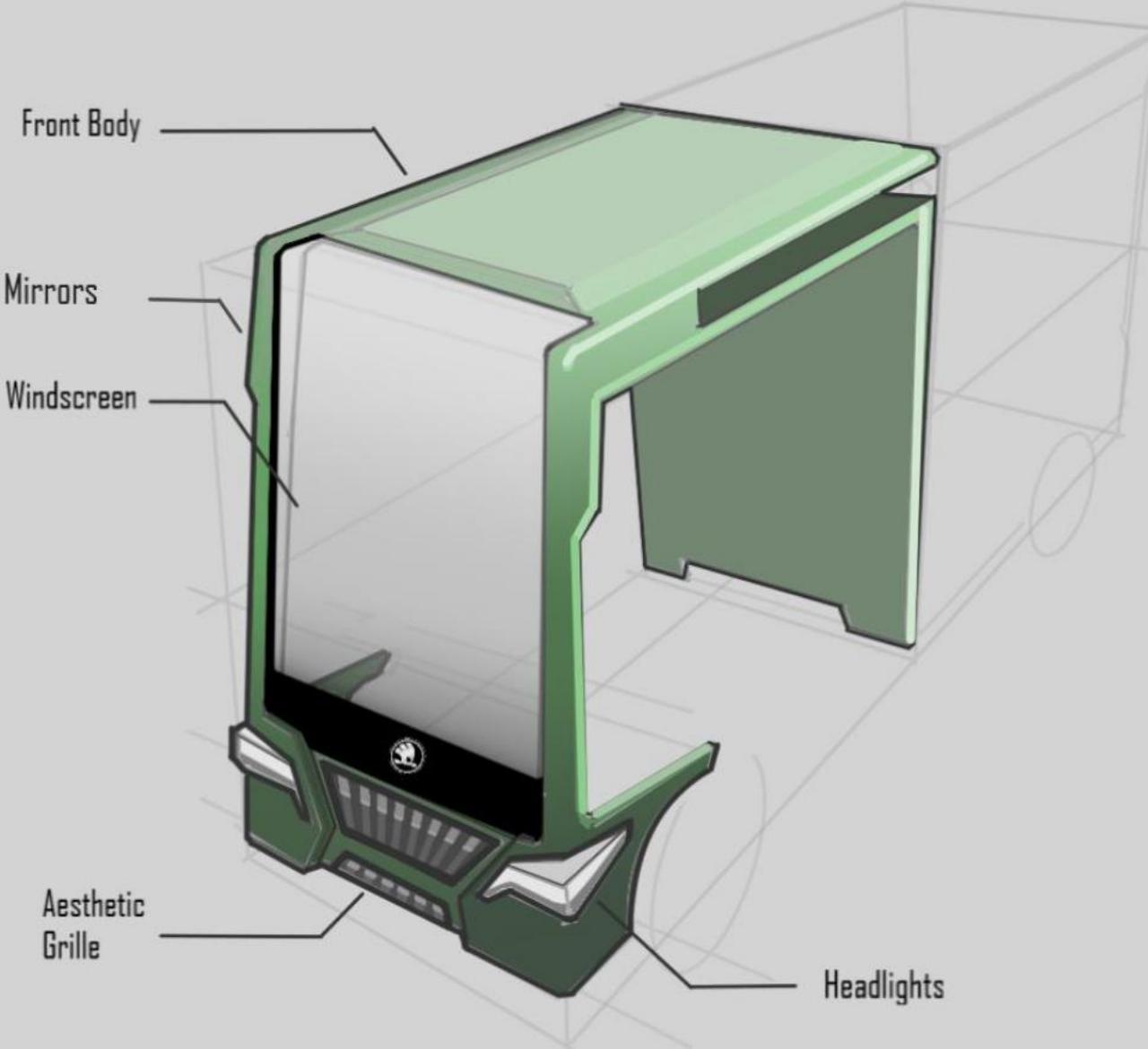
CONCEPT REFINEMENT



Front Exterior Body Analysis

Mohammed Musa

Concept
Refinement 1



Refinements

Refine Front Body for:

Chassis
Interior Space
Furniture
Headlights
Grille

Canopy
Windscreen
Mirrors
Electricals

Refine Windscreen & Mirrors

Aesthetic
Sunlight
Safety

Refine Grille for Aesthetics

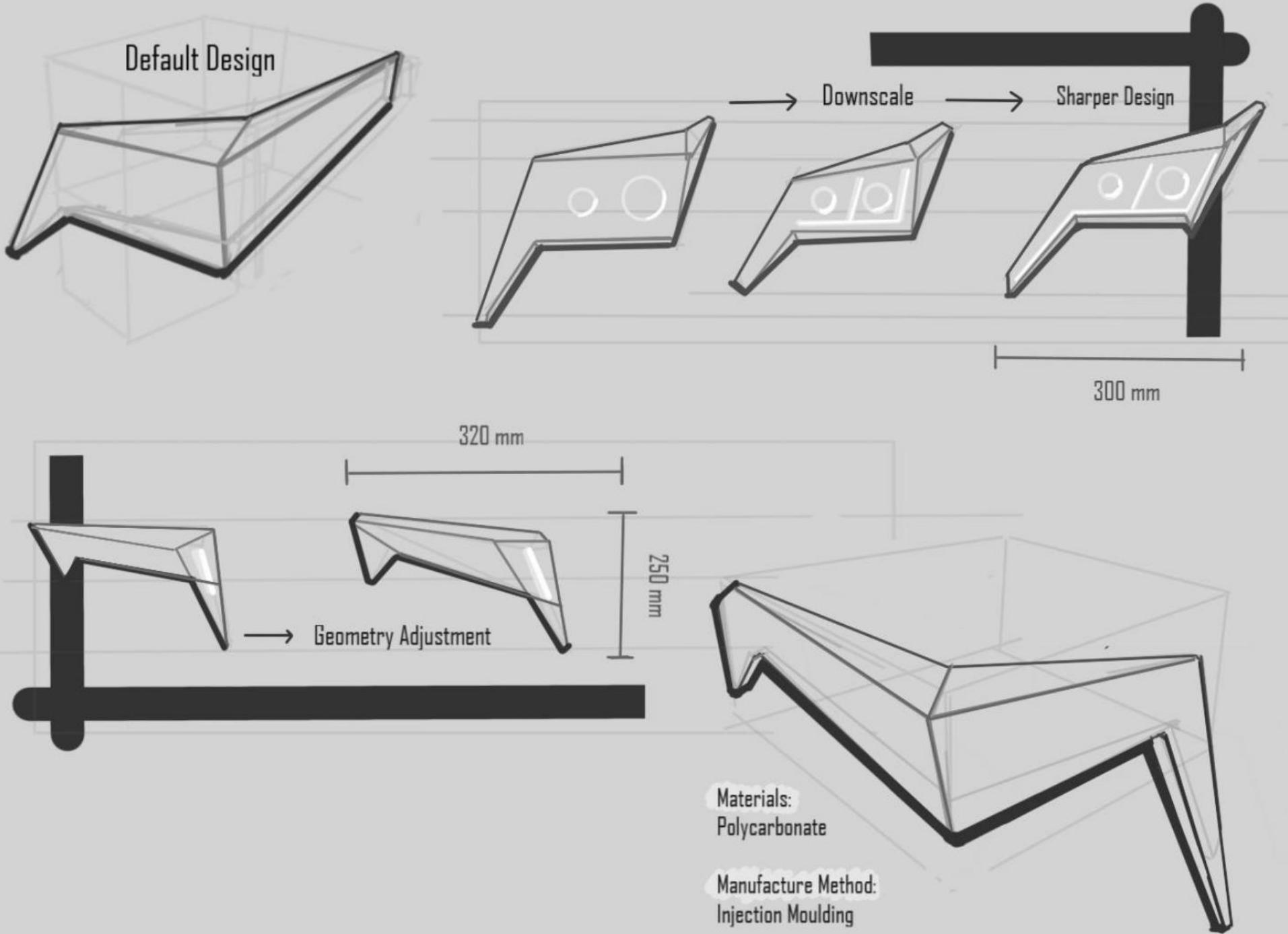
Refine Headlights for Aesthetics

All need to be Manufacturable

Headlights Refinement

Mohammed Musa

Concept
Refinement 1



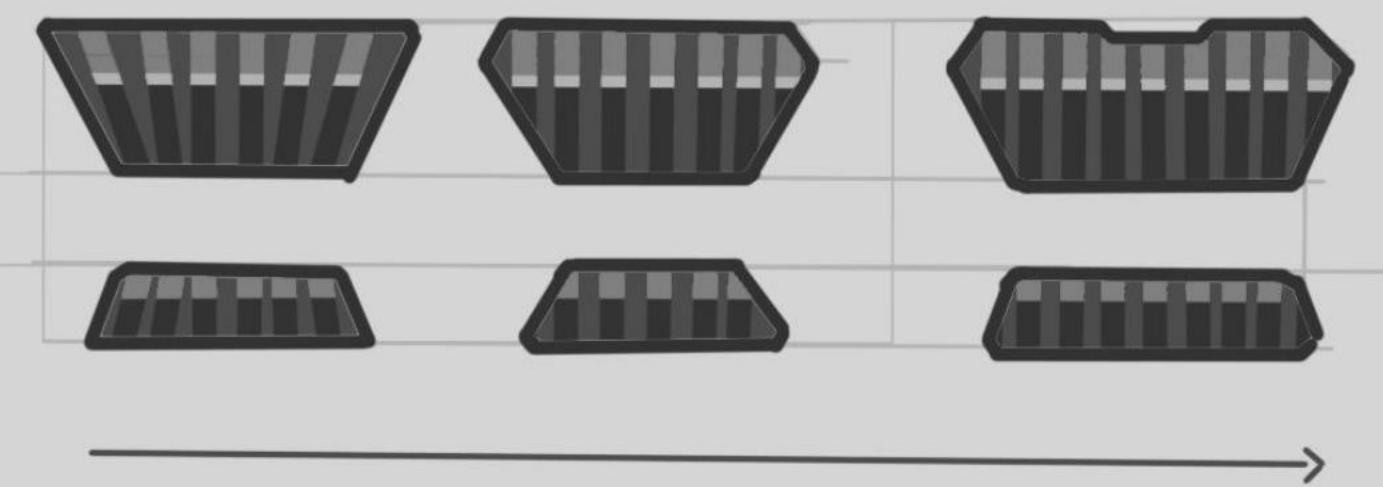
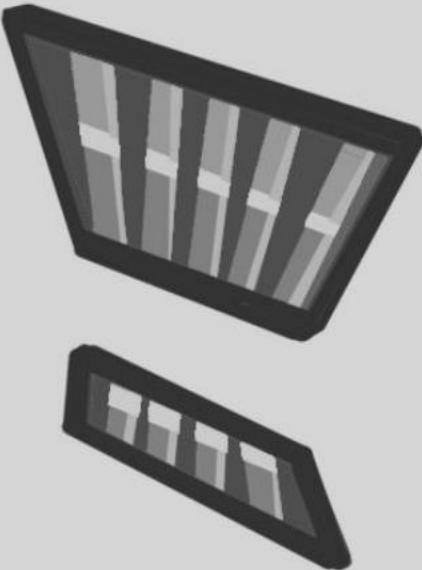
Aesthetic Grille Refinement

Concept
Refinement 1

Mohammed Musa

Skoda Grille Outline Refinement

Default Grille



Material:
ABS

Manufacture Method:
Injection Moulding

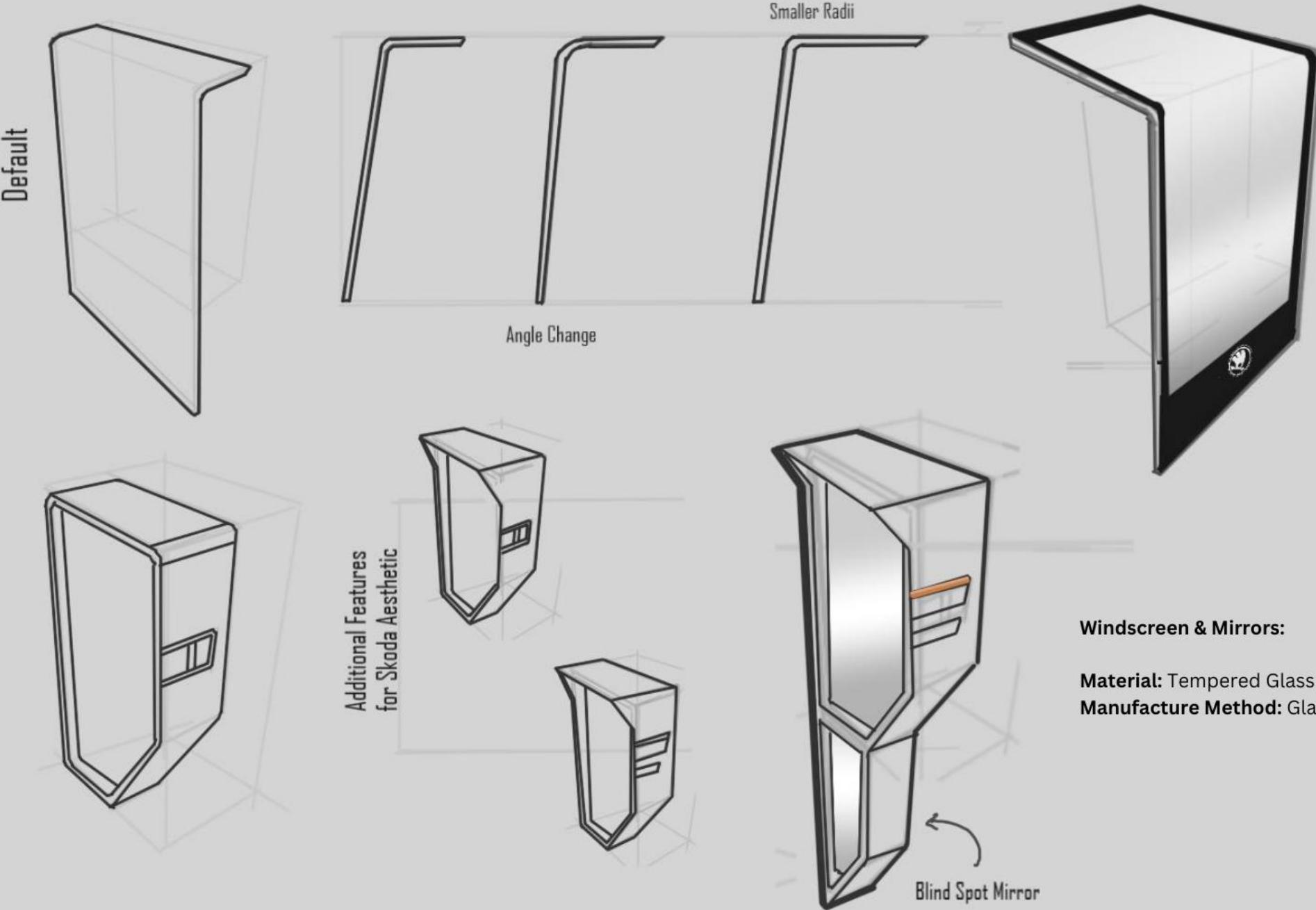


Grille Bars Refinement

Windscreen & Mirror Refinement

Mohammed Musa

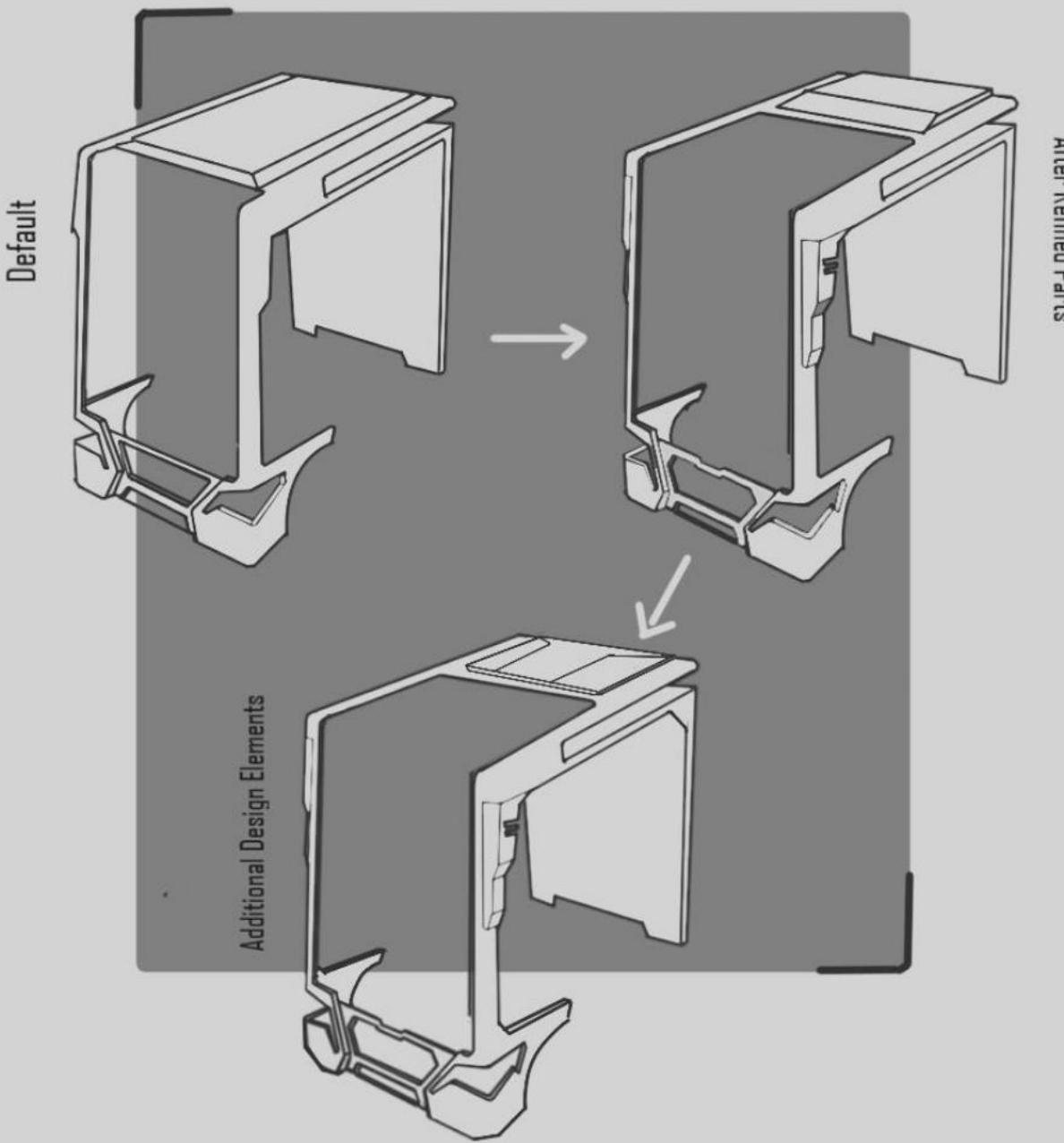
Concept
Refinement 1



Front Exterior Body Refinement

Concept
Refinement 1

Mohammed Musa



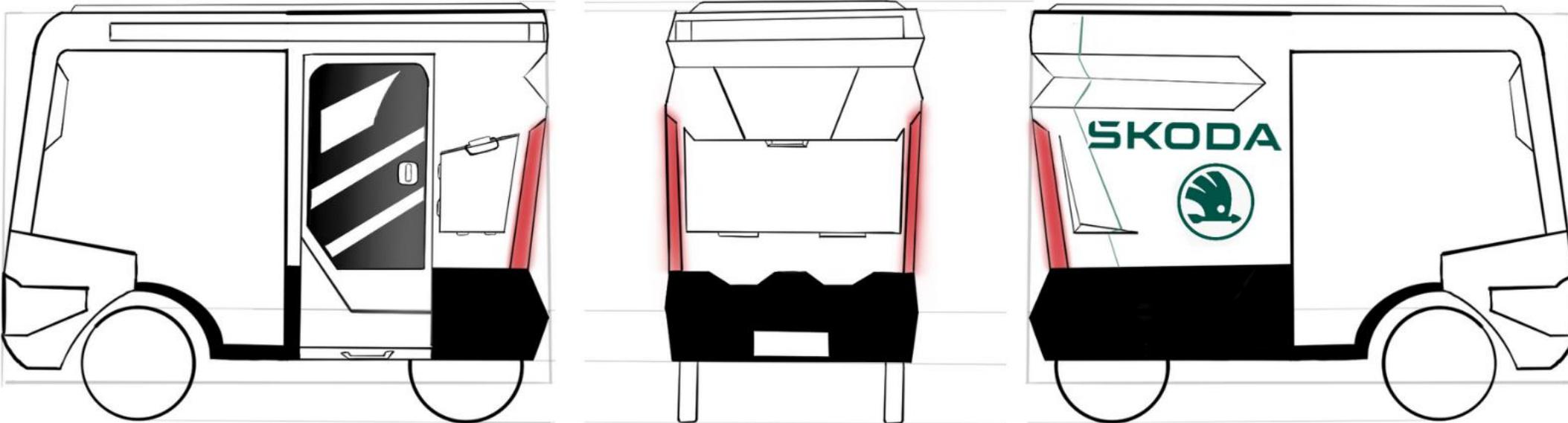
Material:
Aluminum

Manufacture Method:
Sheet Metal + Welding

Overview of Testbox

JiaShu Huang

Concept
Refinement



Material

Main Body -- Aluminum

Ramp -- Aluminum

Rear Lights -- Polycarbonate

Wheels -- Aluminum & Rubber

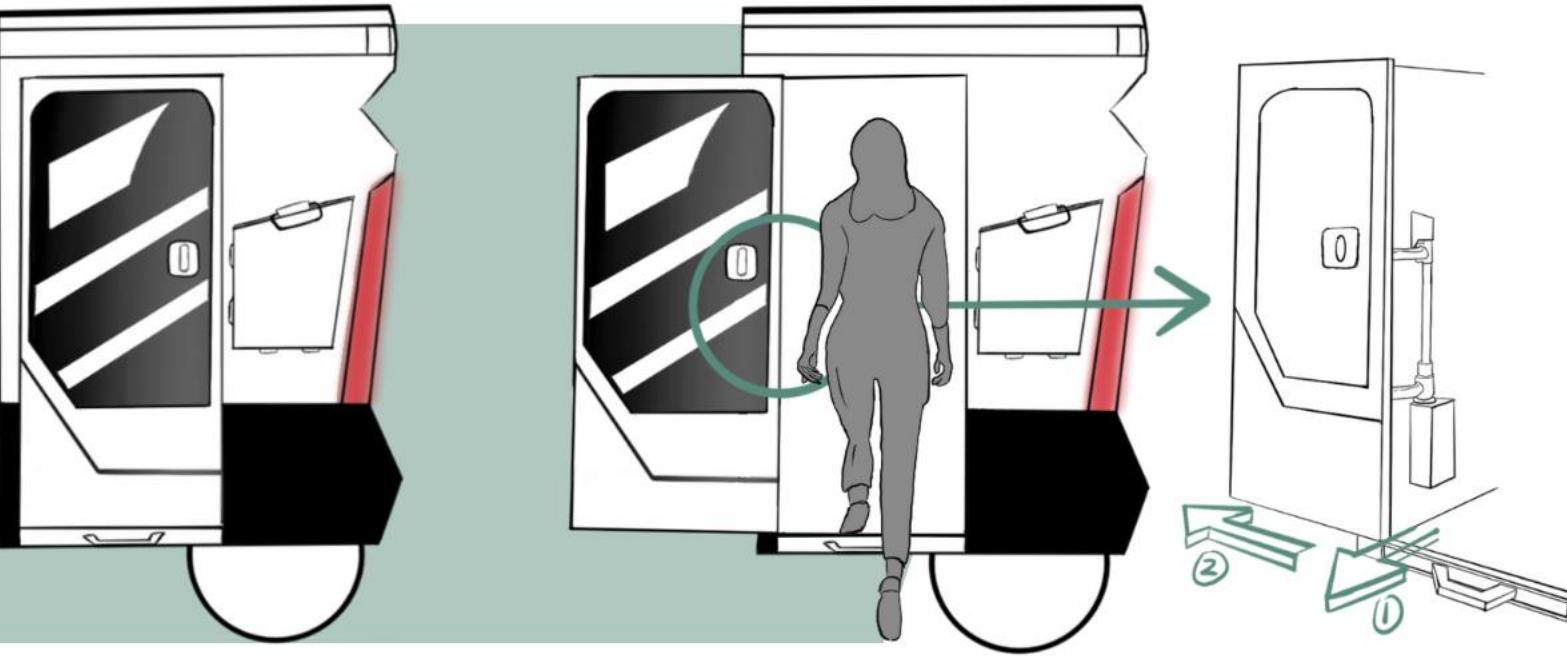
Side Window -- Tempered Glass

Foldable Table -- ABS

Features on Side

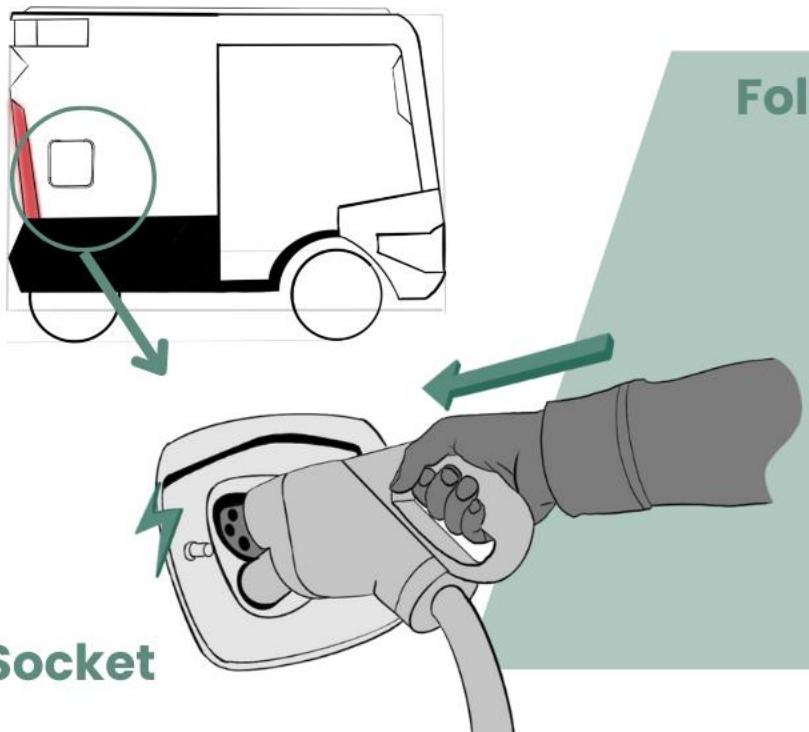
Jiashu Huang

Concept
Refinement



Door

- ① Pull the door out
- ② Slide it sideways



Foldable Table



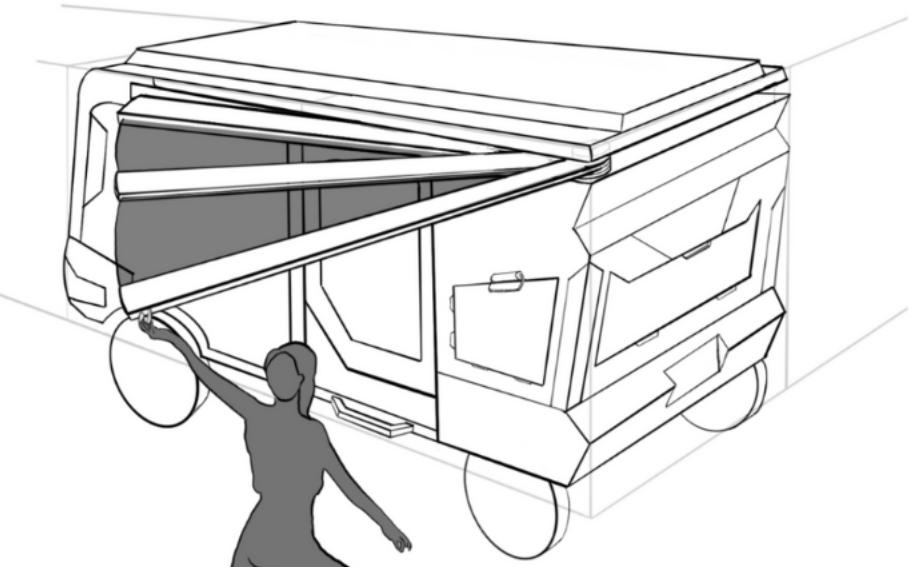
Ramp

- ① Pull out the board under the door
- ② Put it down

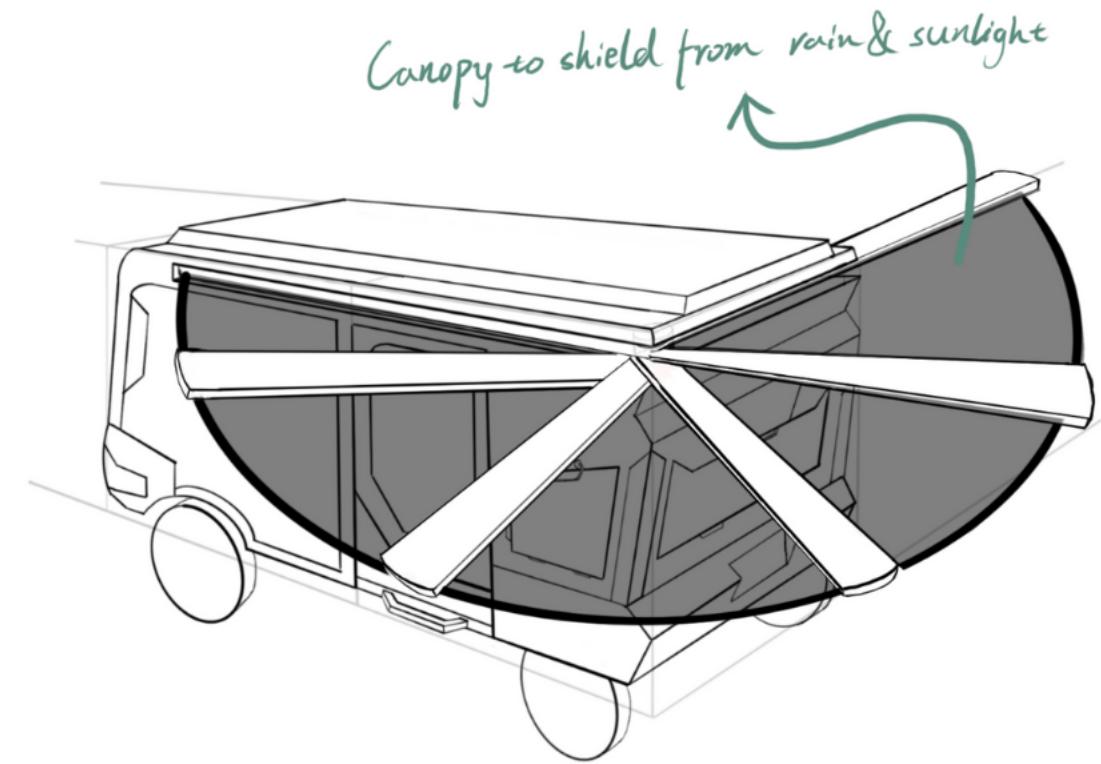
Pop-Out Canopy

jiashu Huang

Concept
Refinement



Overhead grip reach of
5th female : 1824.1 mm



Material:

Fabric -- Oxford Cloth; Ribs -- Aluminium

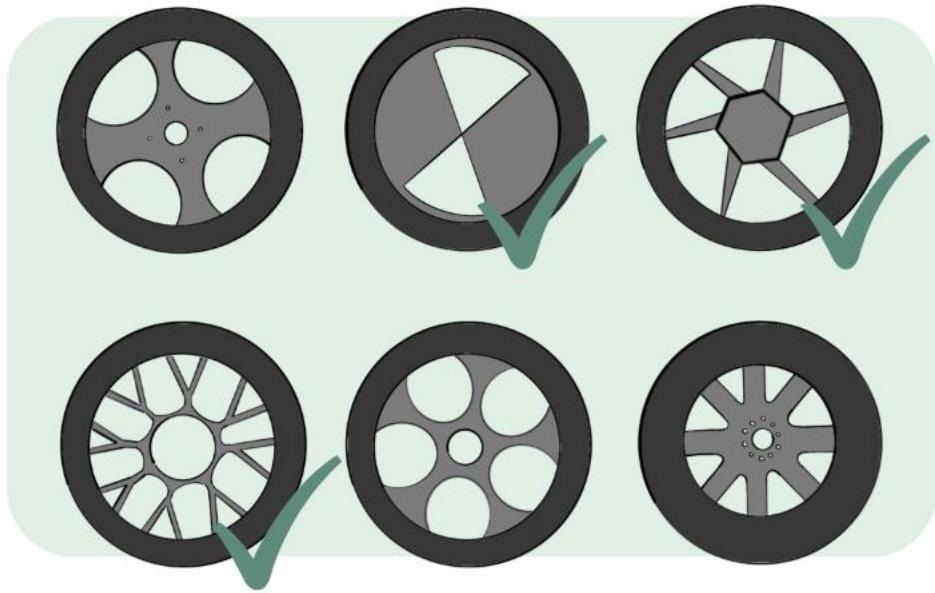
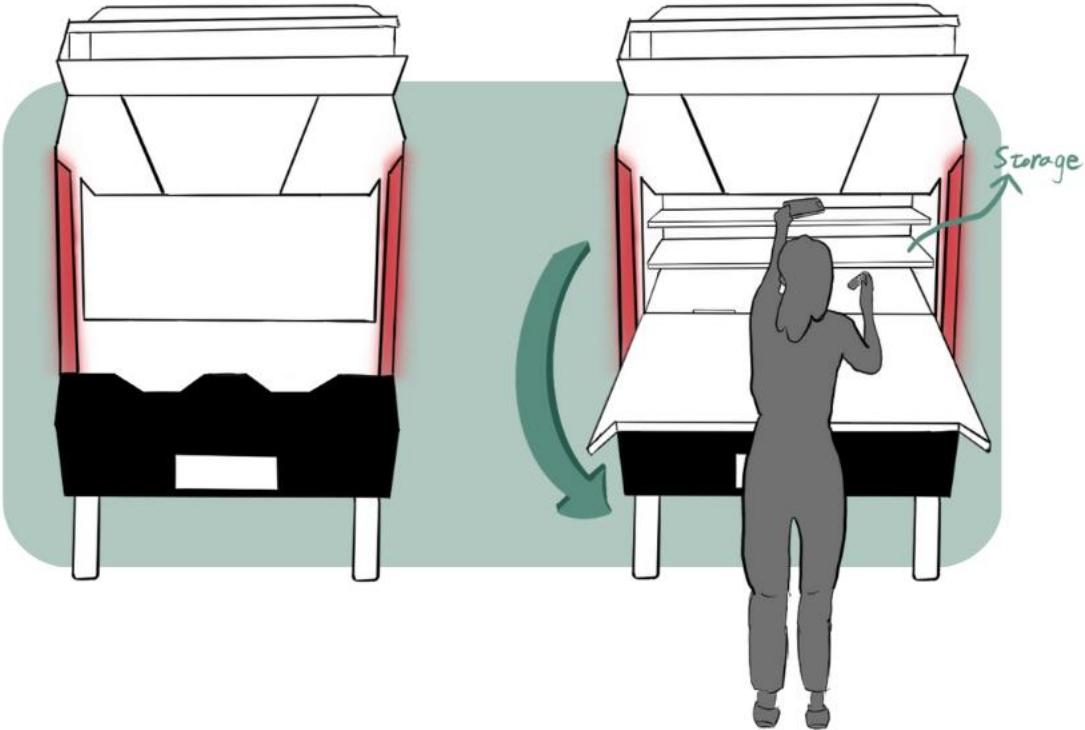
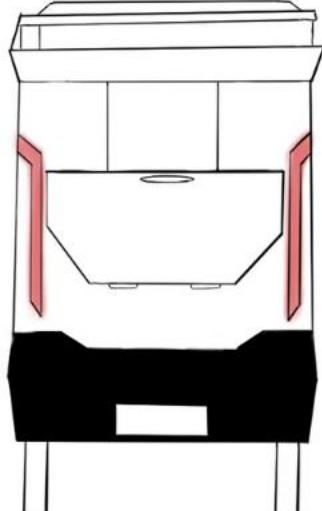
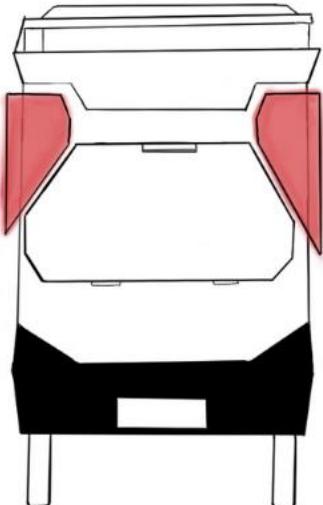
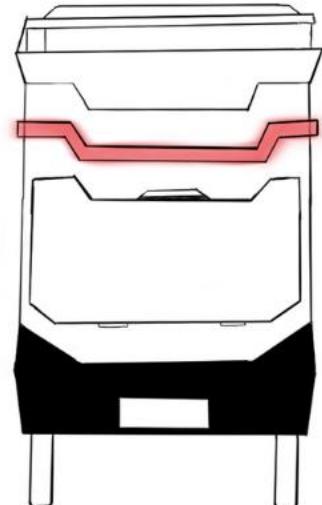
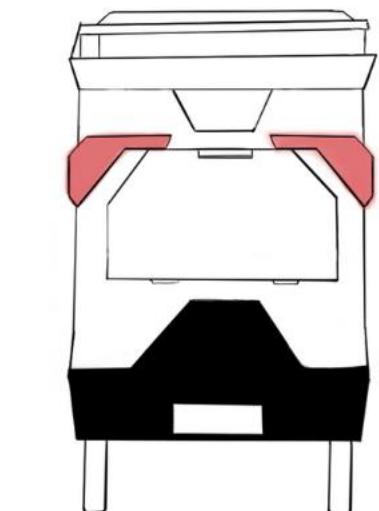
Process:

- ① Grab the pull ring at one end of the rib
- ② Pull towards the back of the testbox
- ③ Clamp the rib over the slot in the rear

Rear Lights & Storage & Wheels

Concept
Refinement

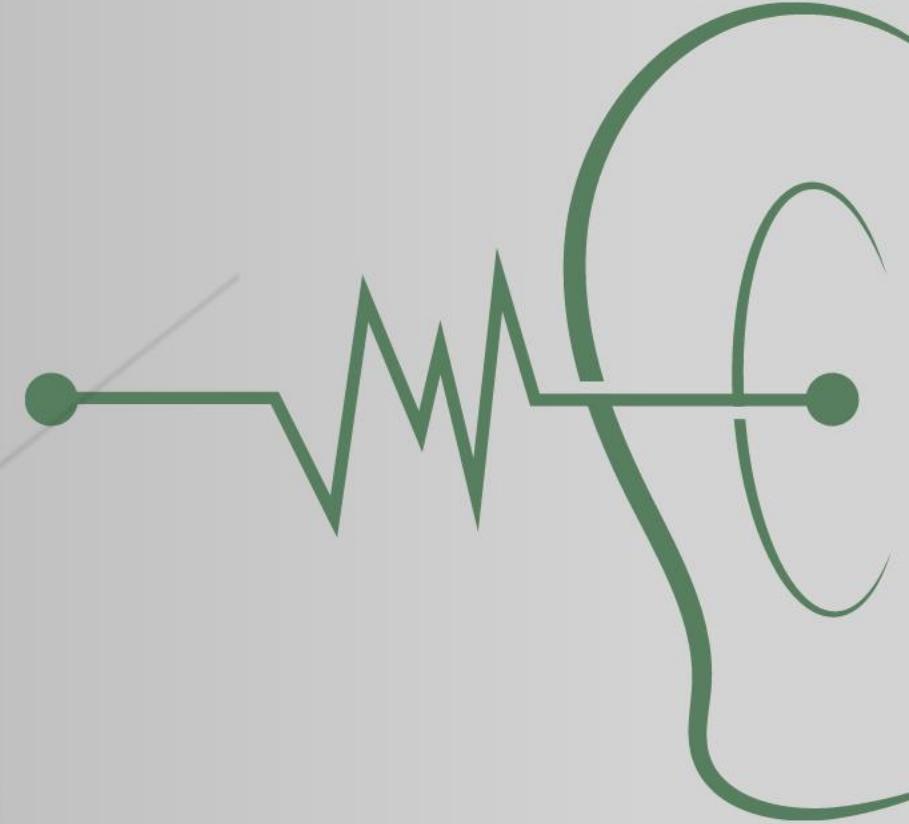
Jiashu Huang



Testbox Refinement

Jiashu Huang

Concept
Refinement

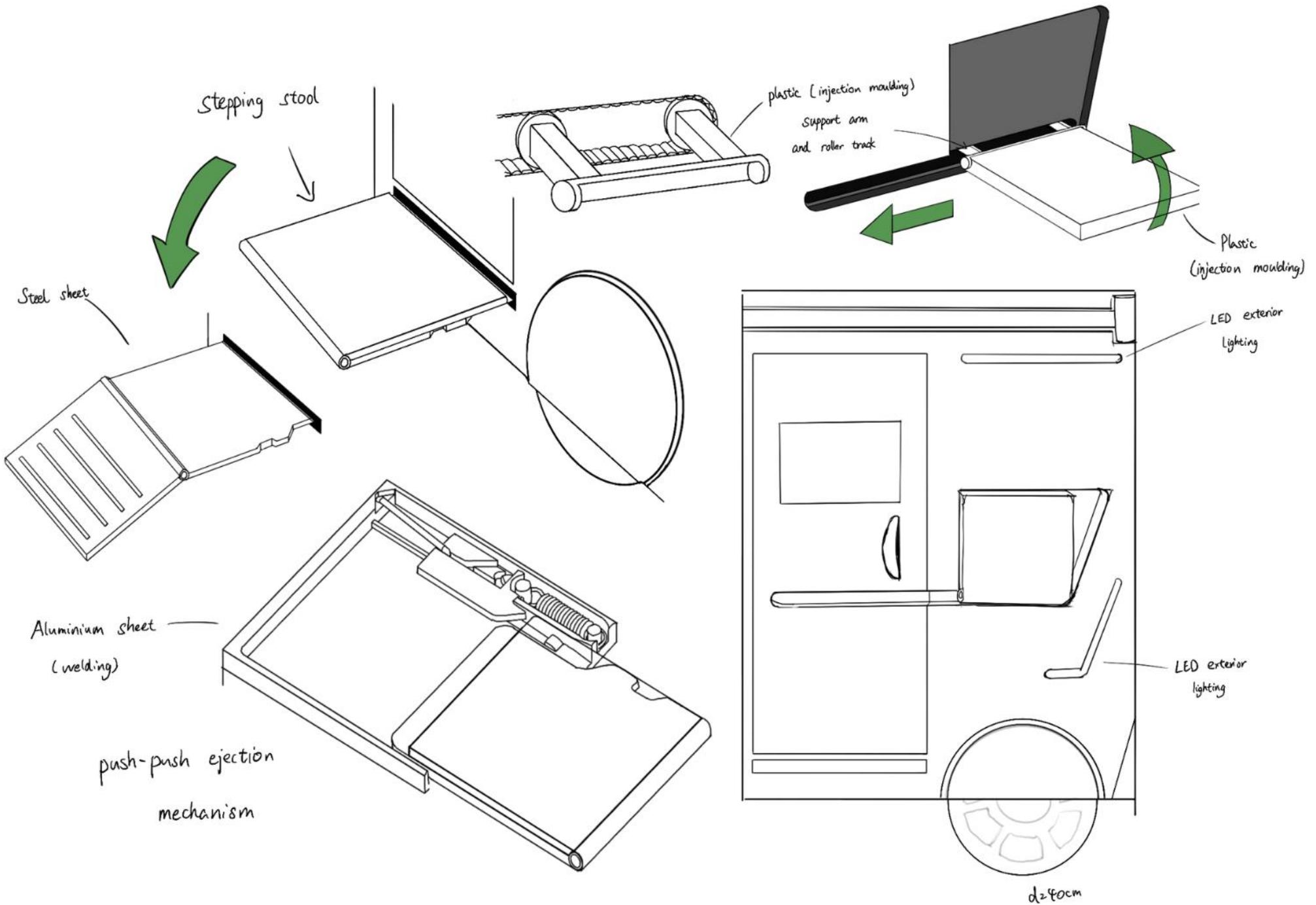


Medical Service Design Refinement

Qicheng Liu

Concept
Refinement

Ramp, desk and exterior lighting

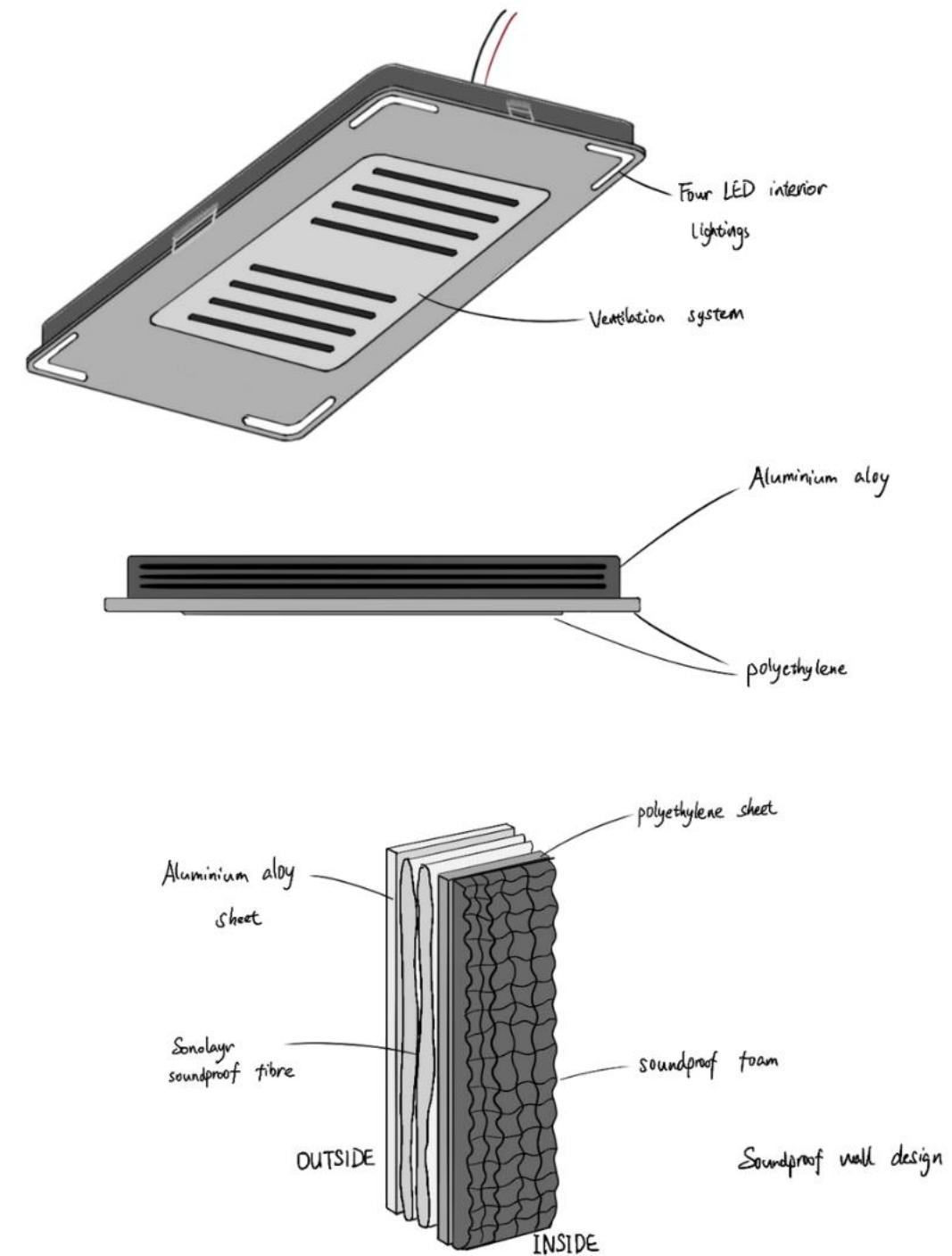
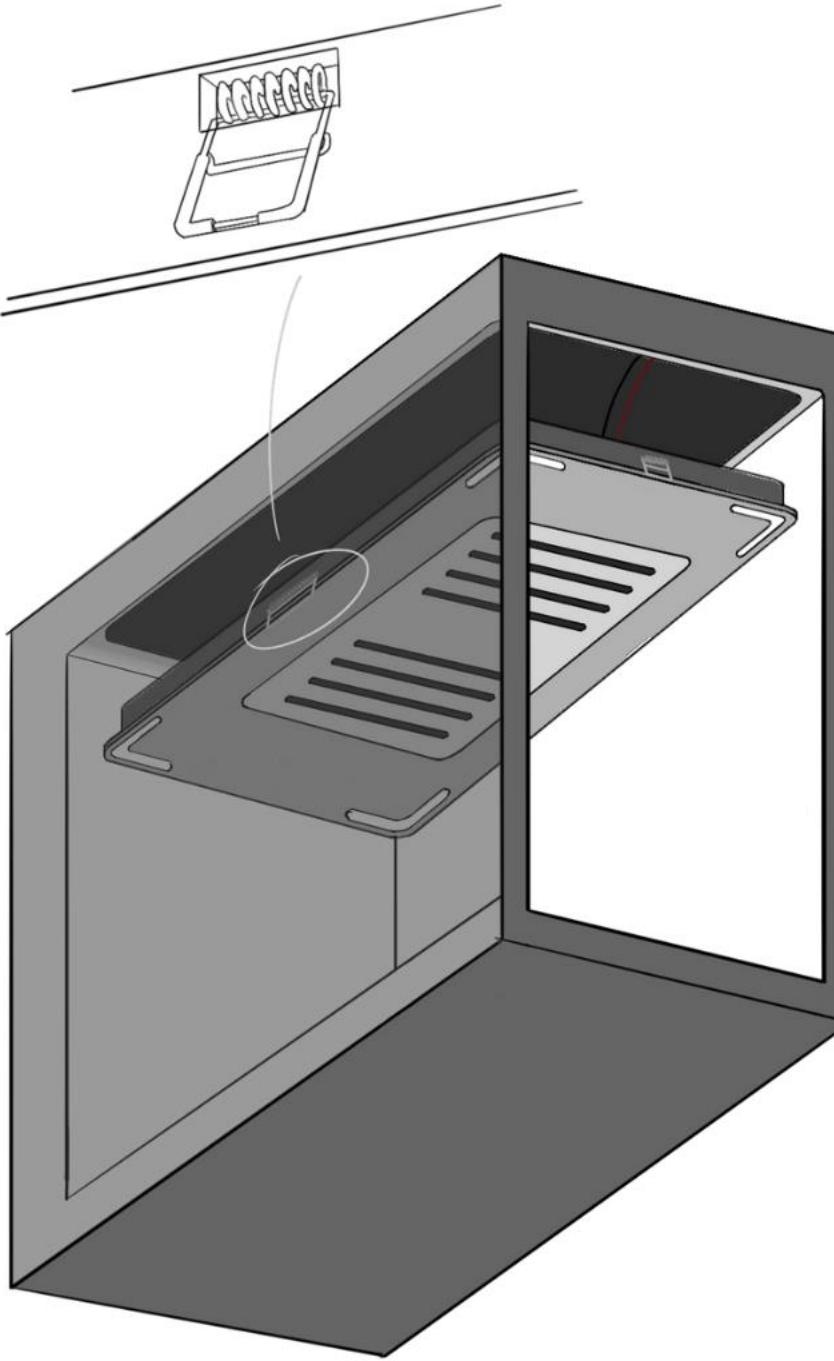


Medical Service Design Refinement

Qicheng Liu

Concept
Refinement

Ventilation and interior lighting

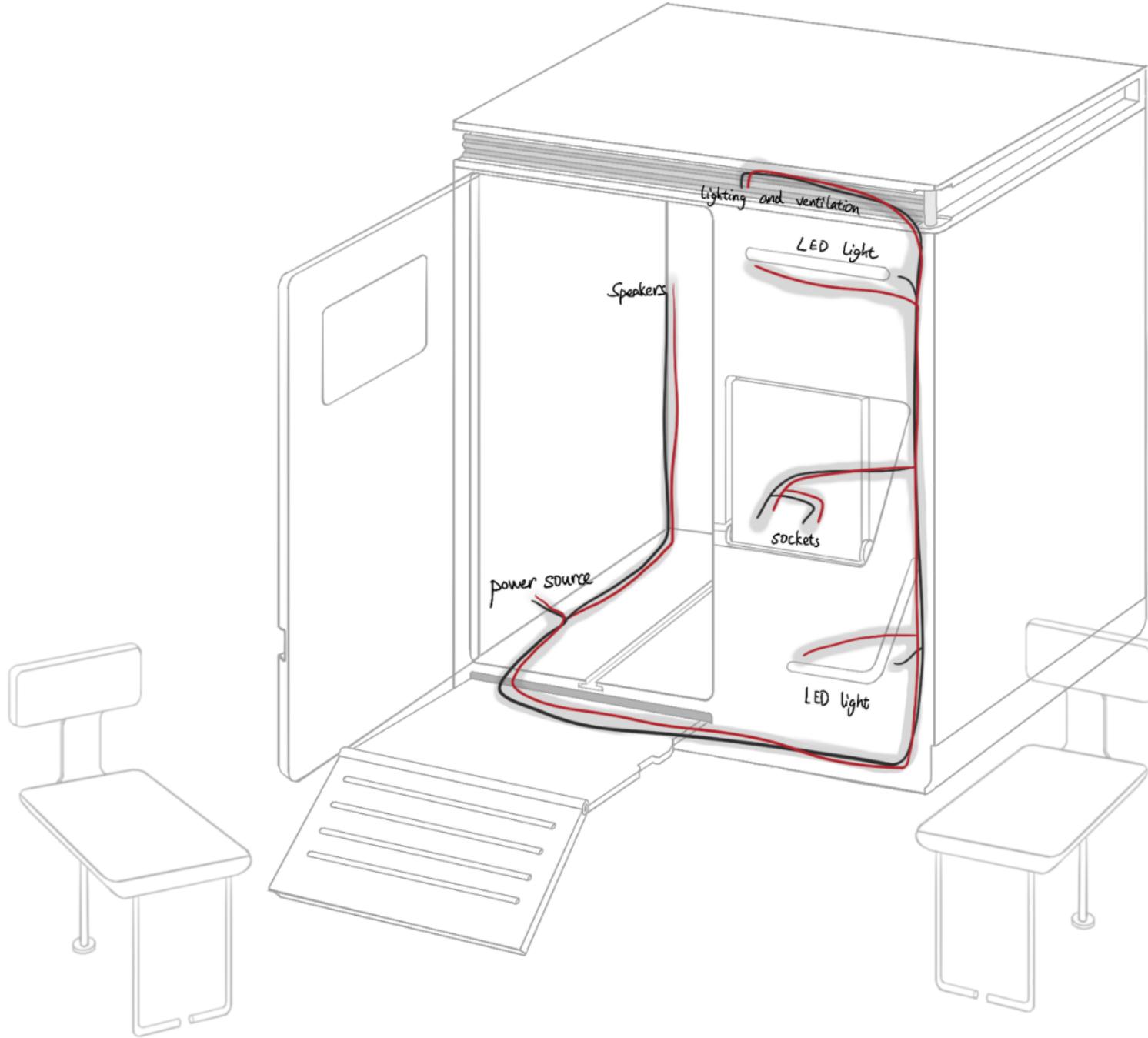


Medical Service Design Refinement

Qicheng Liu

Concept
Refinement

Power distribution

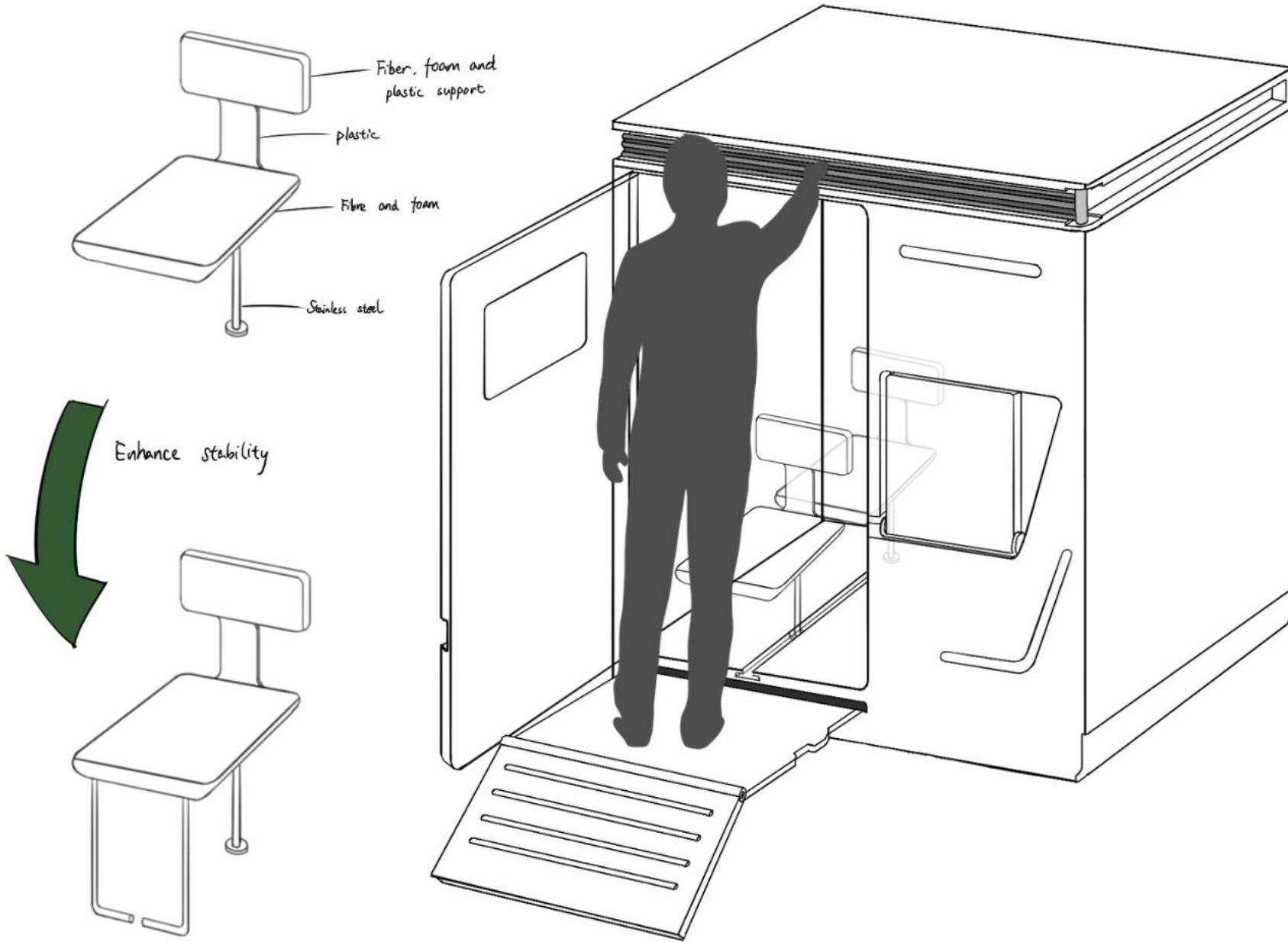


Medical Service Design Refinement

Qicheng Liu

Concept
Refinement

Chairs and stepping stool

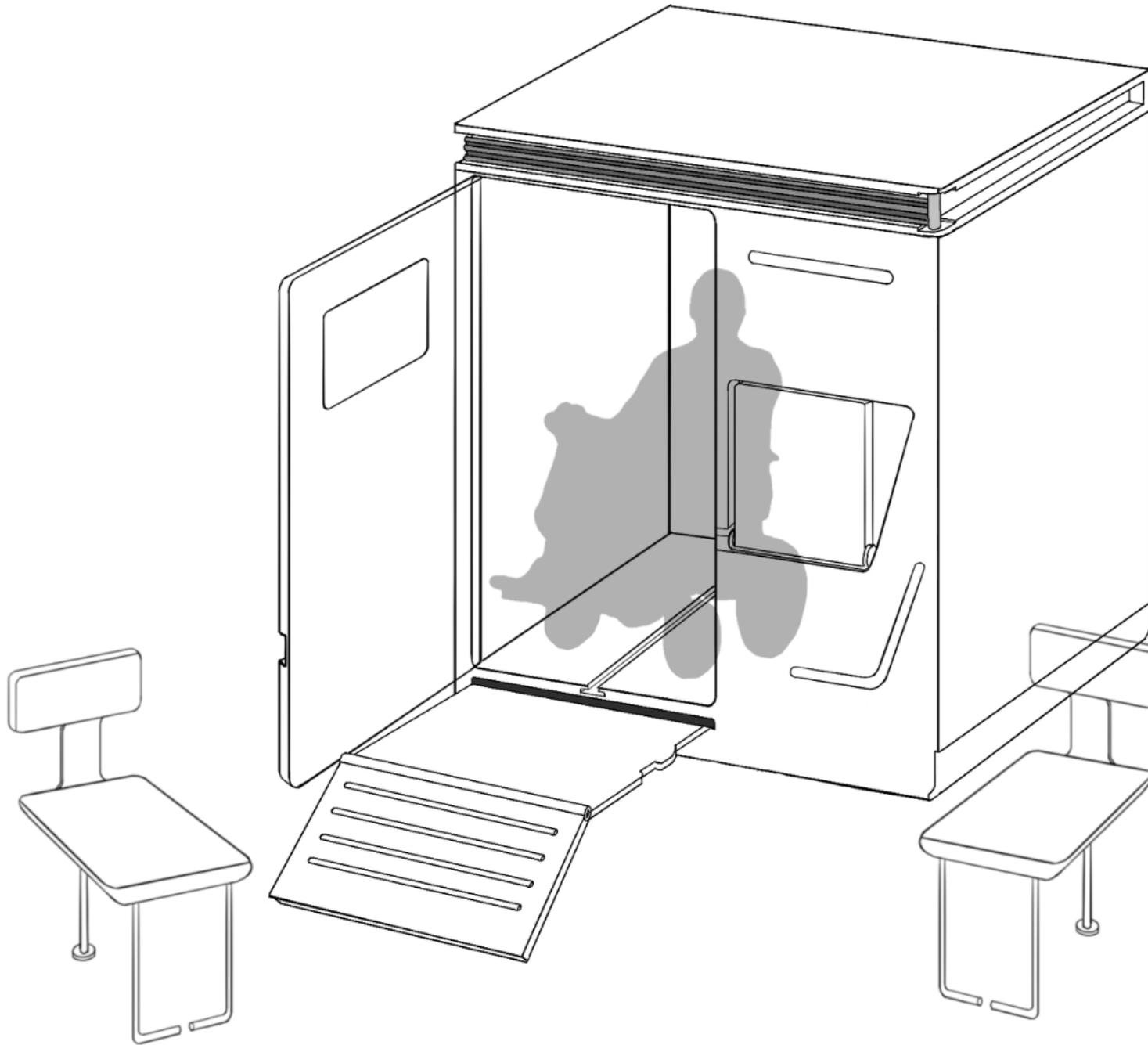


Medical Service Design Refinement

Concept
Refinement

Qicheng Liu

Accessibility

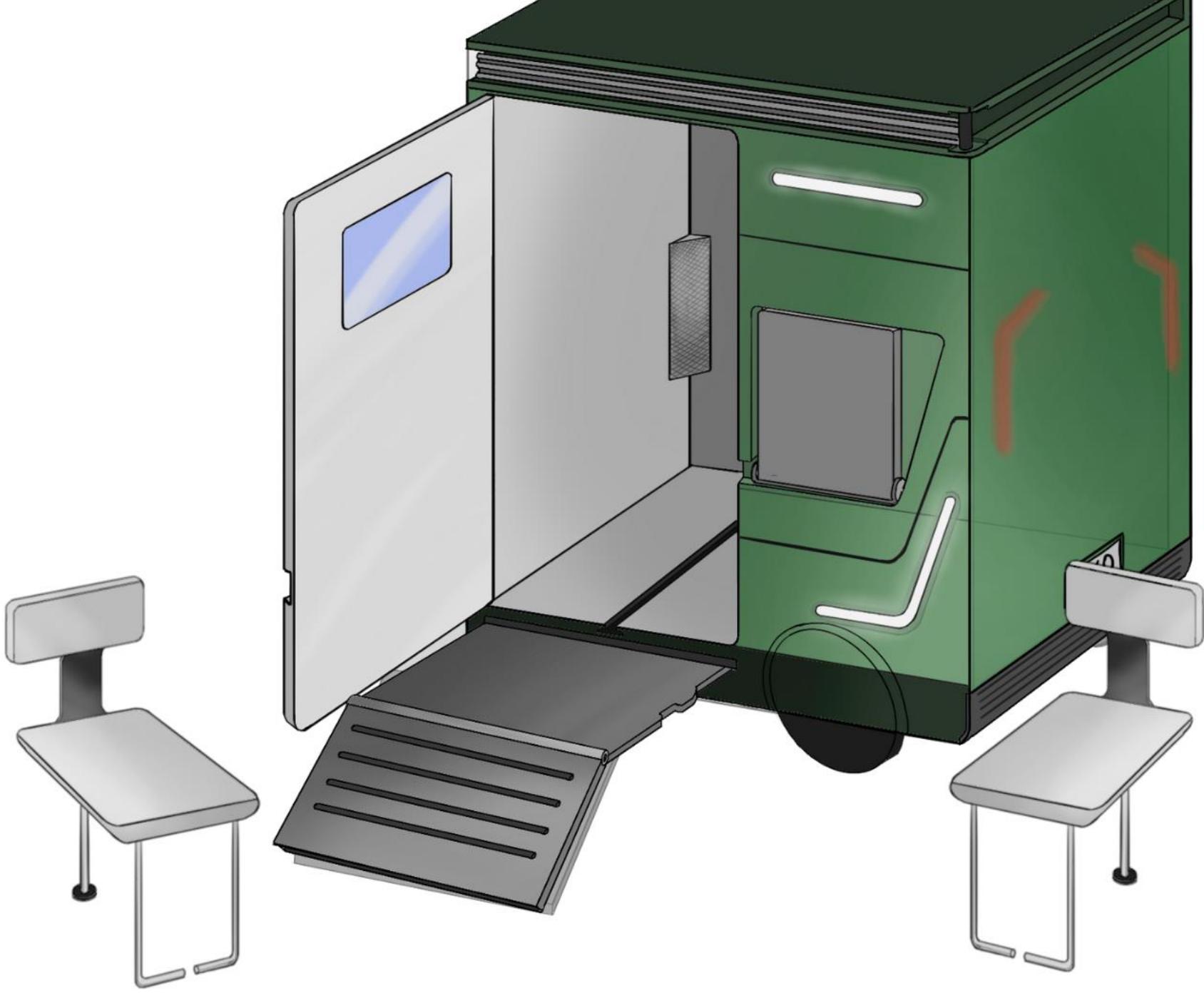


Medical Service Design Refinement

Qicheng Liu

Concept
Refinement

Concept

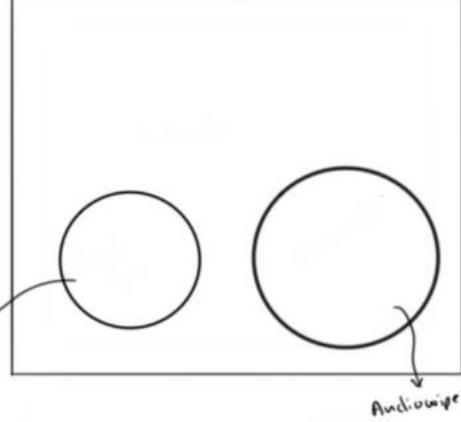
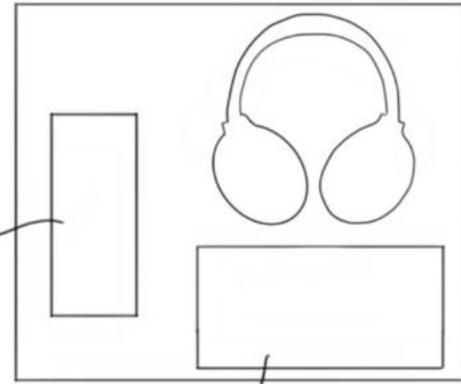
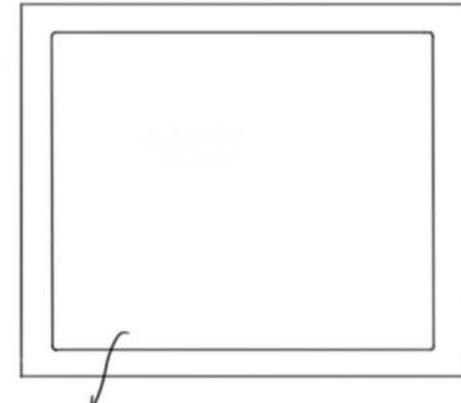
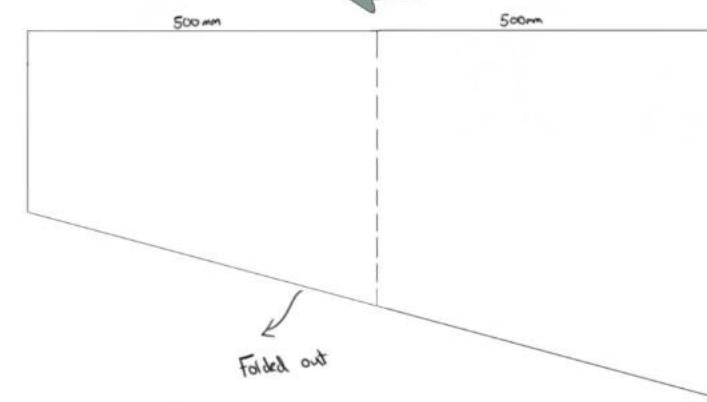
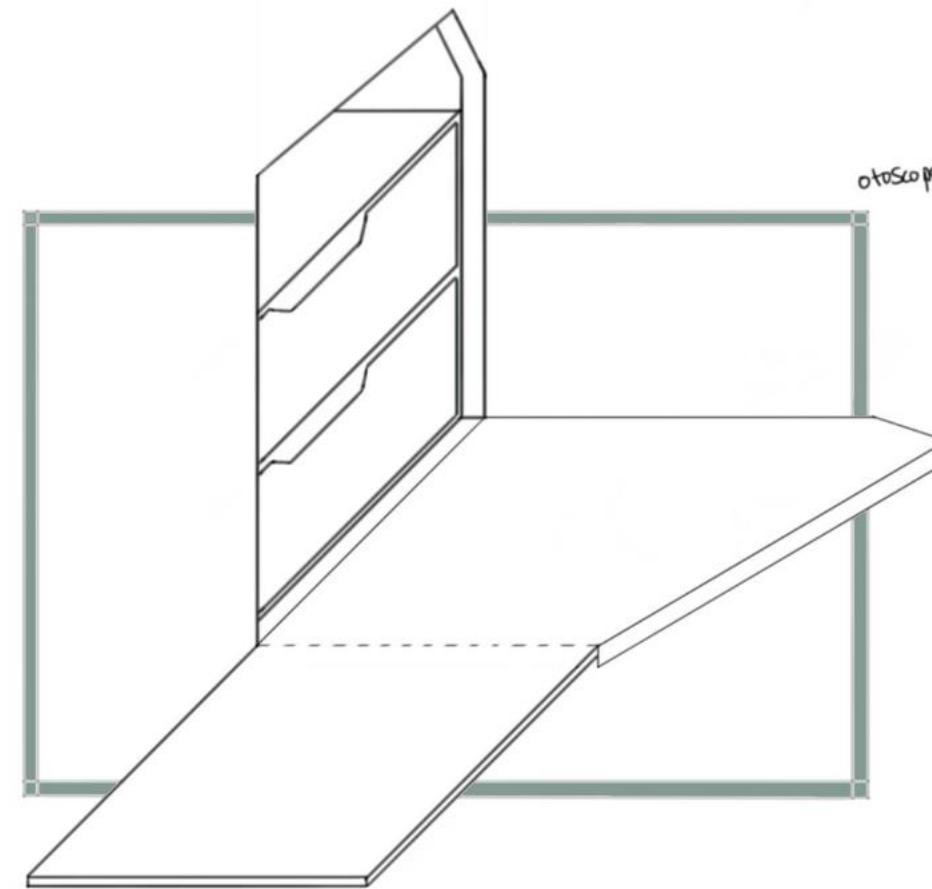
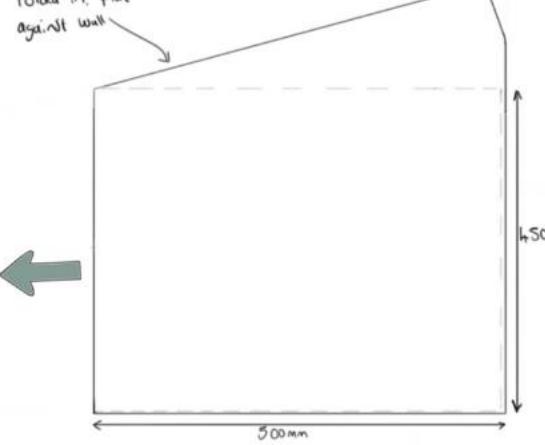
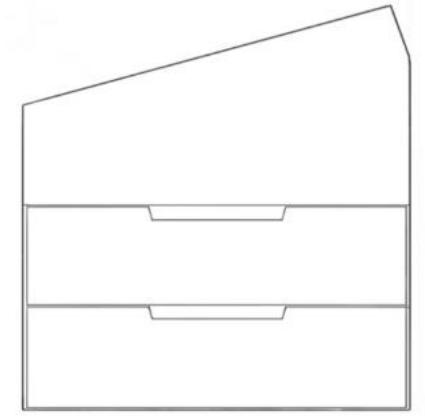
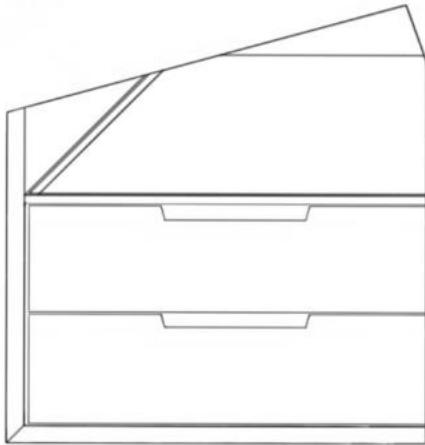


Medical Service Design Refinement

Concept
Refinement

Eleanor Webster

Storage Refinement



Cleaning products

Audiometer

otoscope

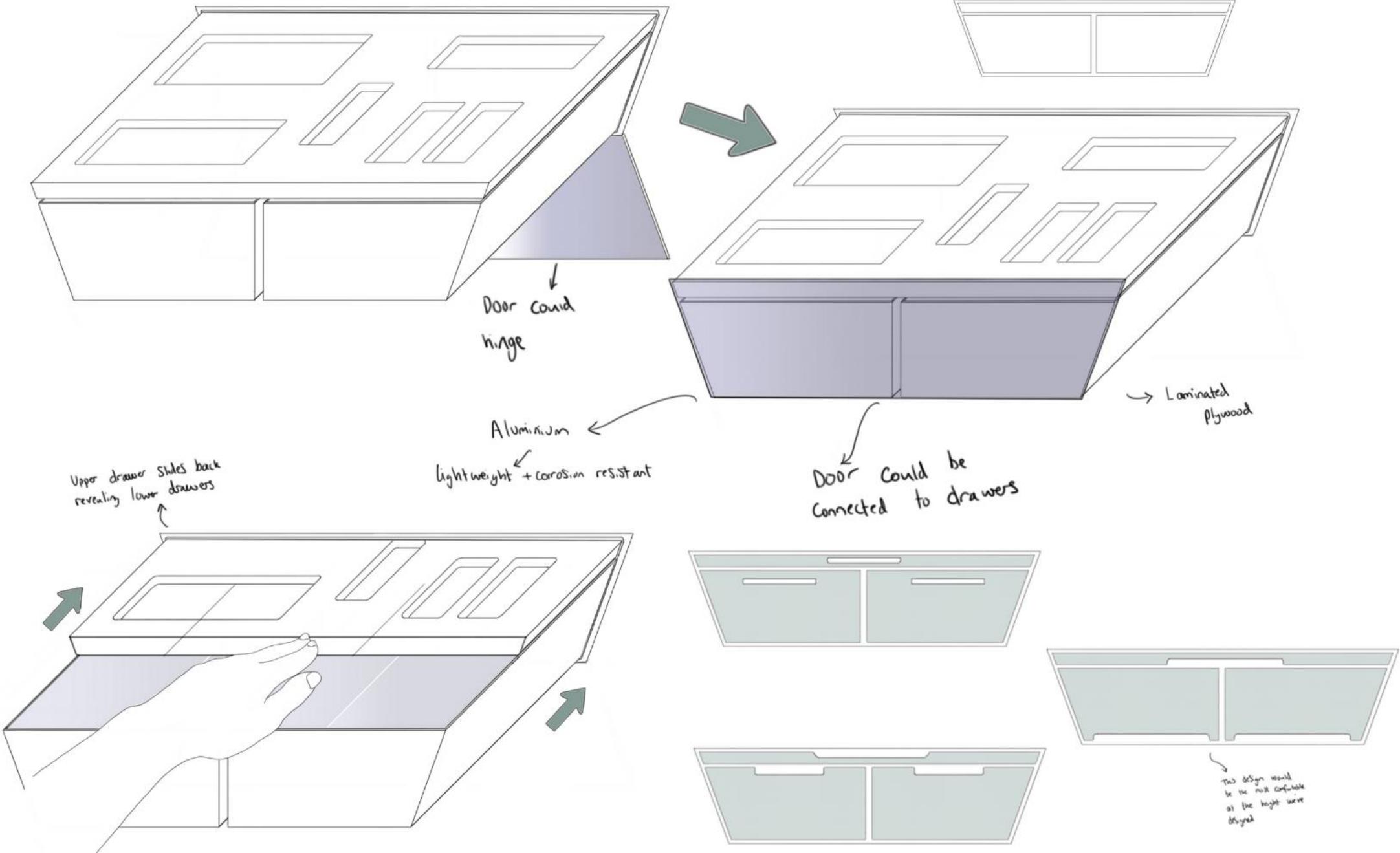
Tympany device

Audiotometer

Medical Service Design Refinement

Concept
Refinement

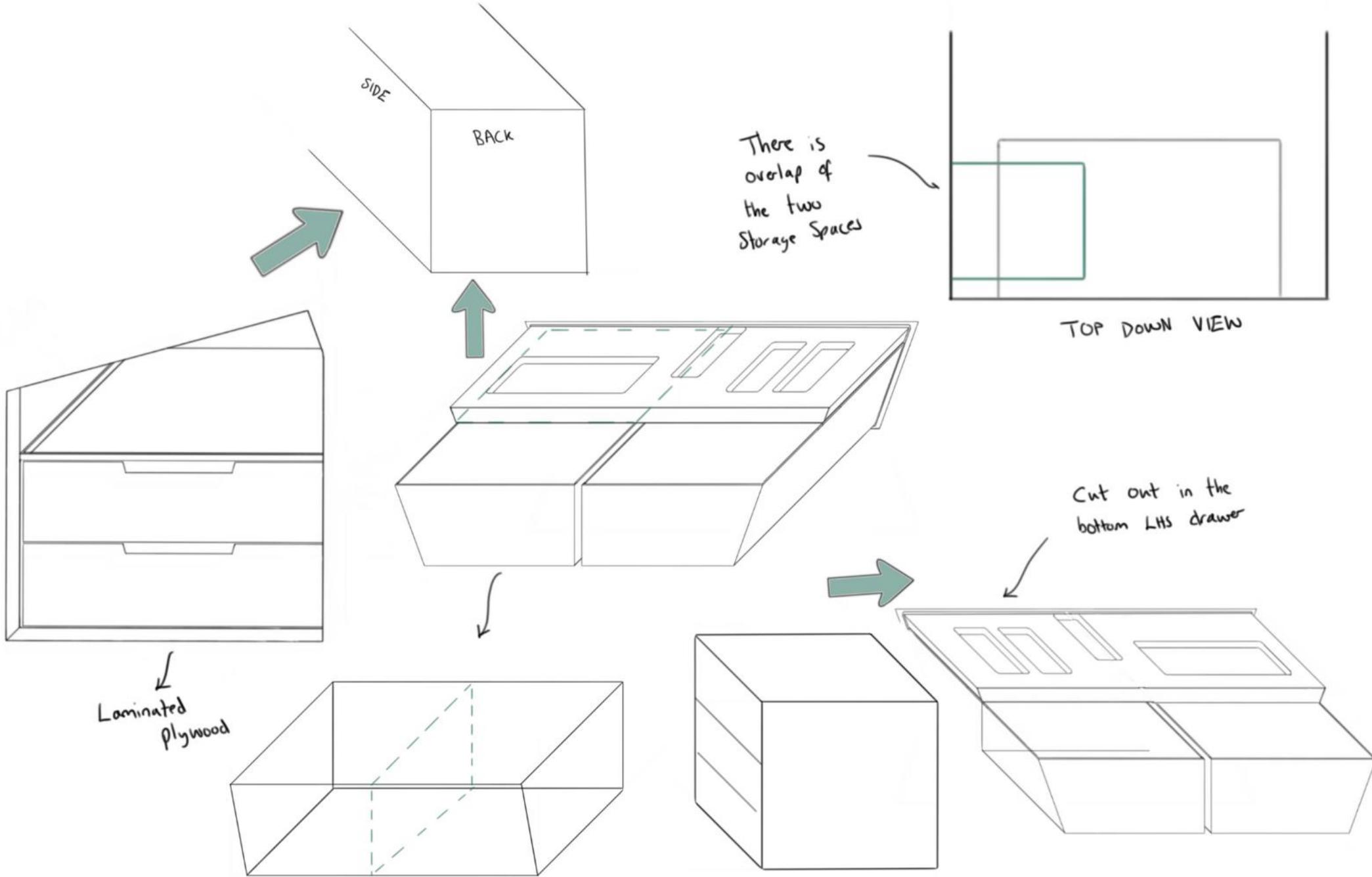
Eleanor Webster



Medical Service Design Refinement

Eleanor Webster

Concept
Refinement

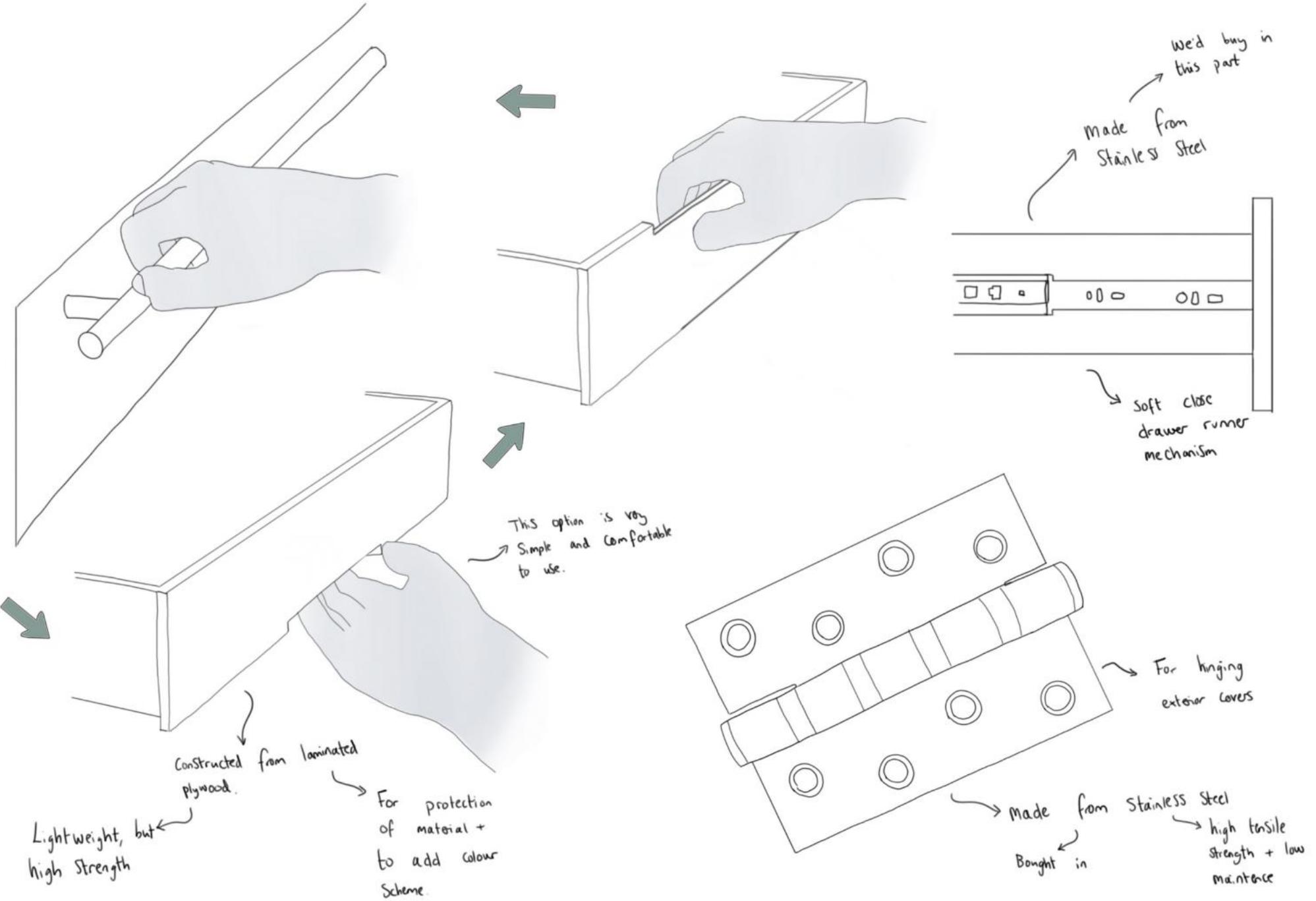


Medical Service Design Refinement

Eleanor Webster

Concept
Refinement

Handles and Drawer Mechanisms

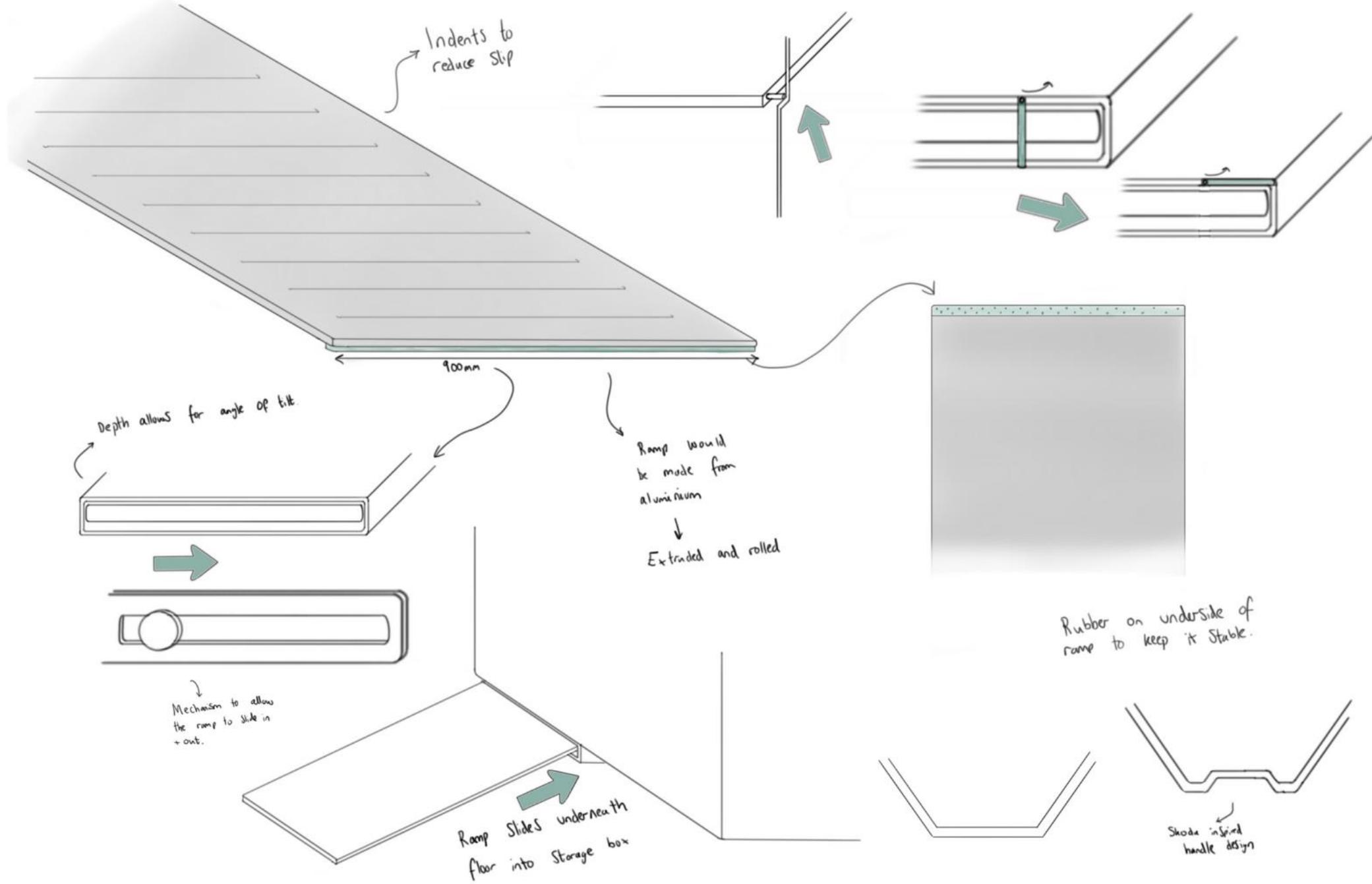


Medical Service Design Refinement

Eleanor Webster

Concept
Refinement

Ramp Refinement

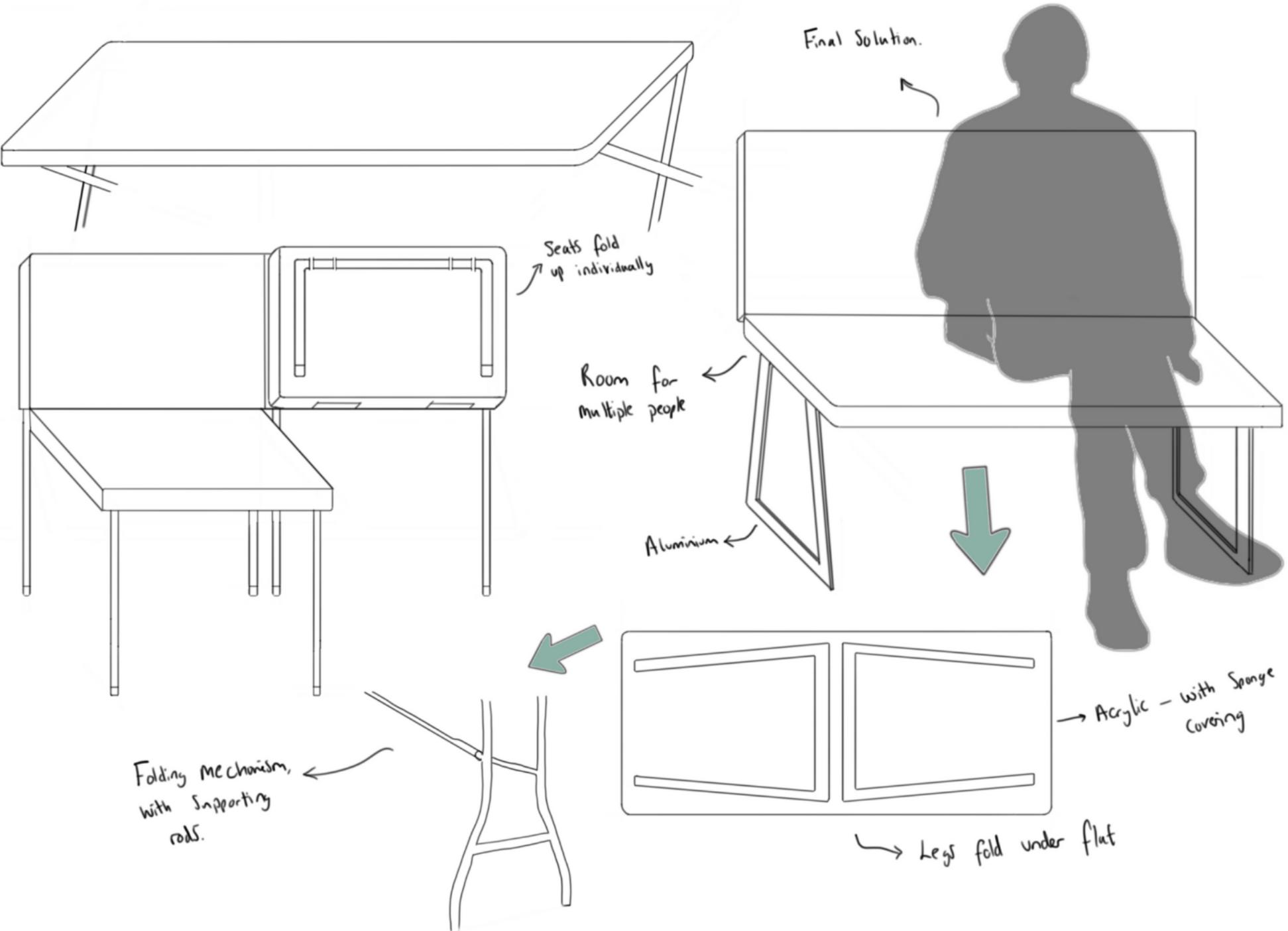


Medical Service Design Refinement

Eleanor Webster

Concept
Refinement

Waiting Area Seating Refinement

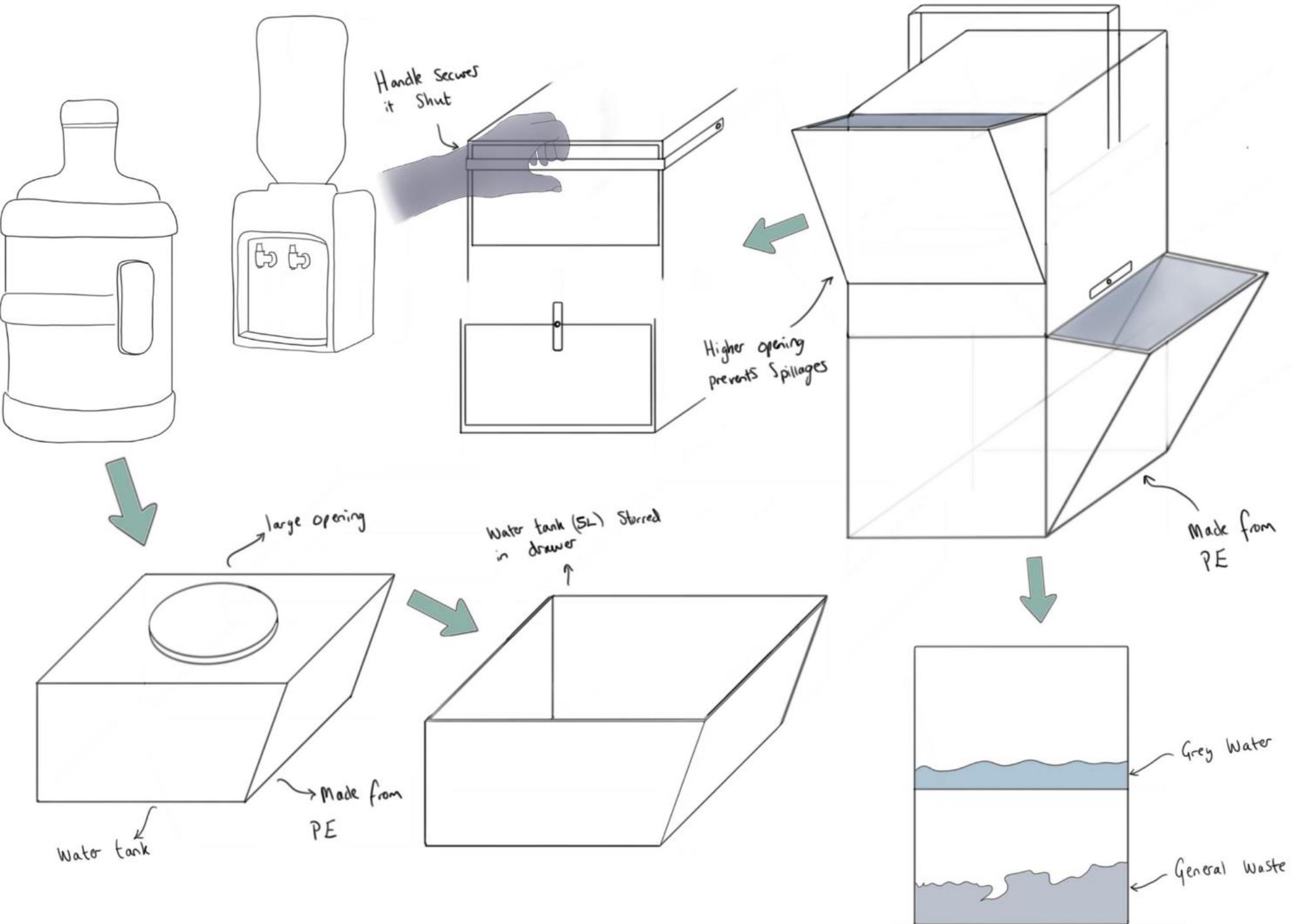


Medical Service Design Refinement

Concept
Refinement

Eleanor Webster

Waste and Water Storage Refinement

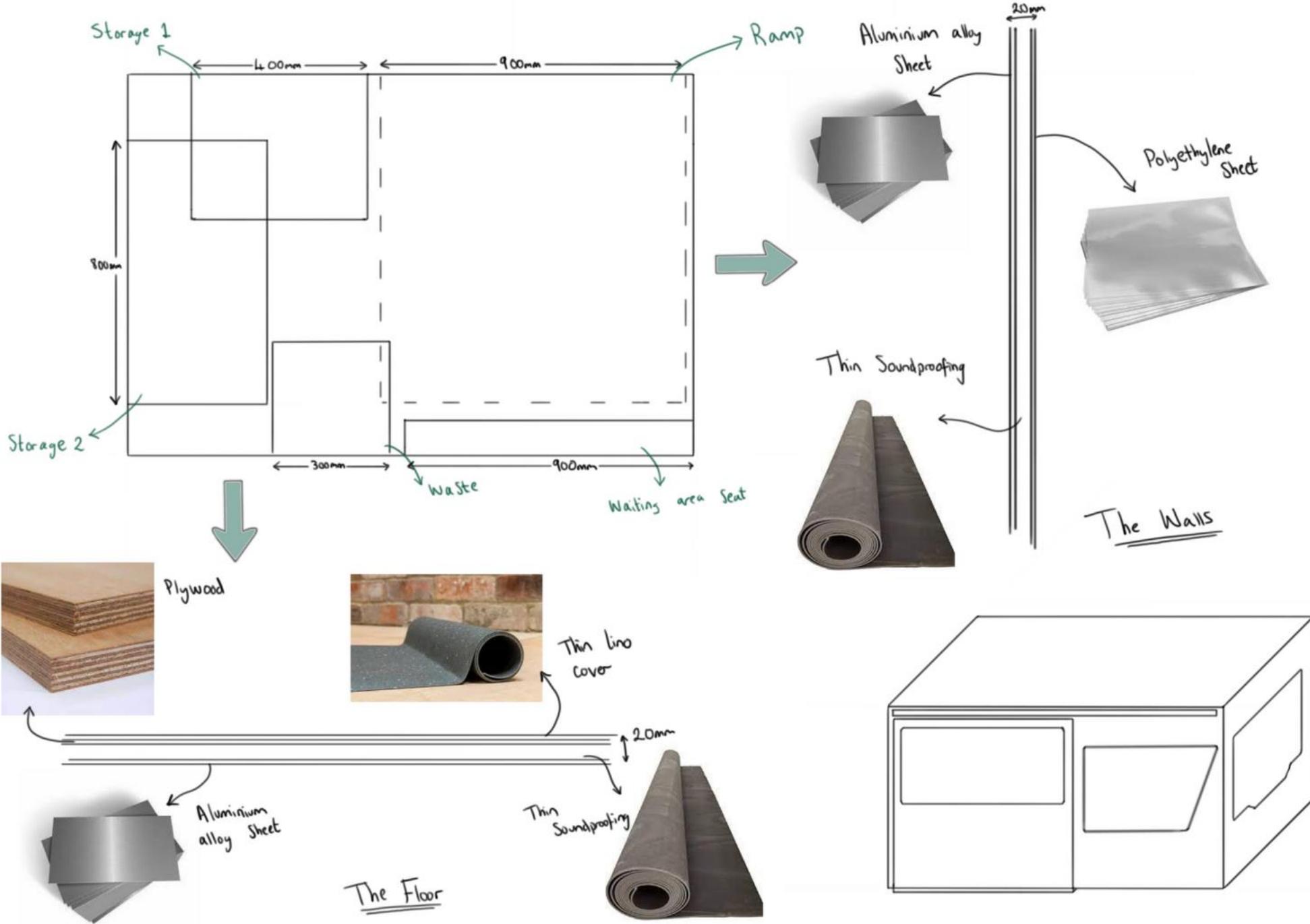


Medical Service Design Refinement

Concept
Refinement

Eleanor Webster

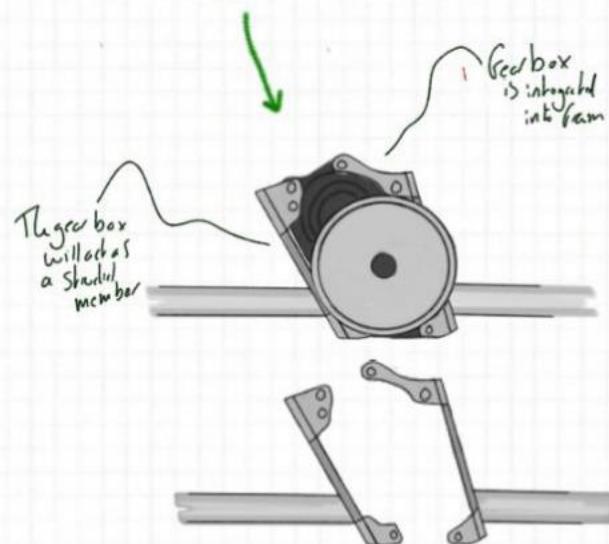
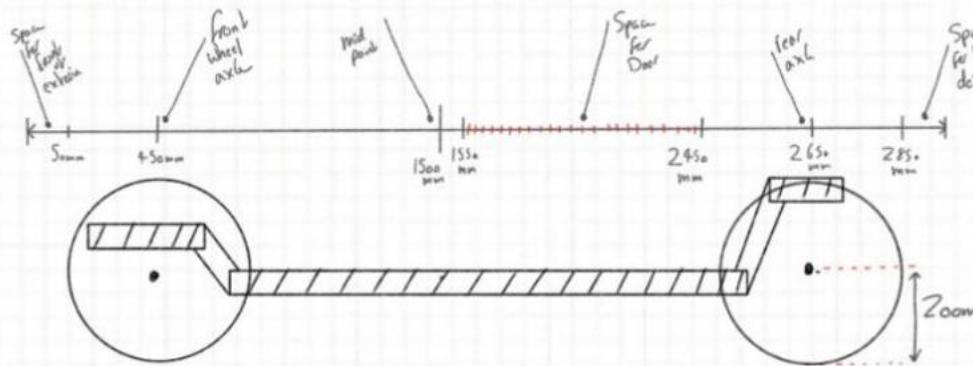
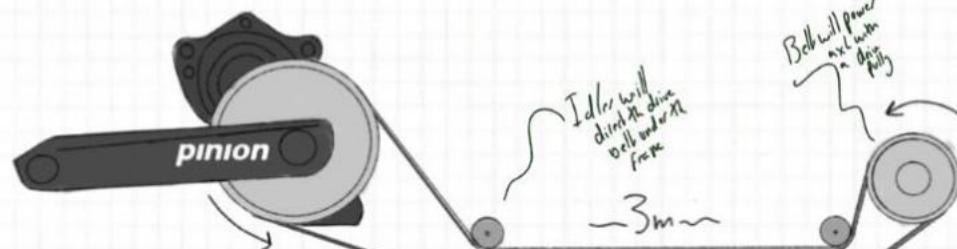
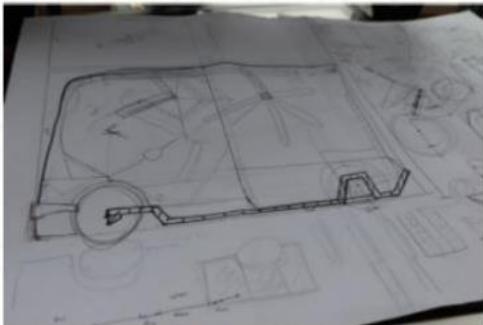
Floor Plan and Materials Refinement



Chassis Design Refinement

Concept
Refinement

Dom Brown



Frame Material choice

Carbon fiber

Carbon fiber is a composite material comprising of carbon-weaved blankets and specialist resin.

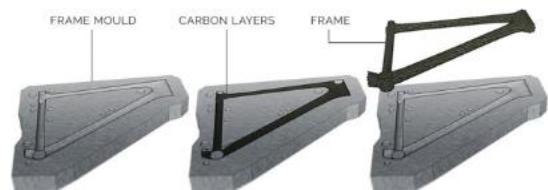
Advantages

- High strength
- Can be formed in complex shapes
- Lightweight

Disadvantages

- liable to impact forces
- hard and expensive to manufacture.
- Weak in some directions
- Hard to joint to sections together

For this application, a monocoque chassis design would be needed so the frame could withstand the required forces. The tooling needed to create a monocoque would be very expensive and add a large element of complication to the manufacturing process.



Aluminum Extrusion

Aluminum Extrusion or piping is a preformed material that can come in a number of profile shapes, wall thicknesses, and lengths.

Advantages

- Very cheap and readily available
- Overall height strength in all forces different
- Sections can be joined easily
- Weight can be kept low if the wall thickness is managed

Disadvantages

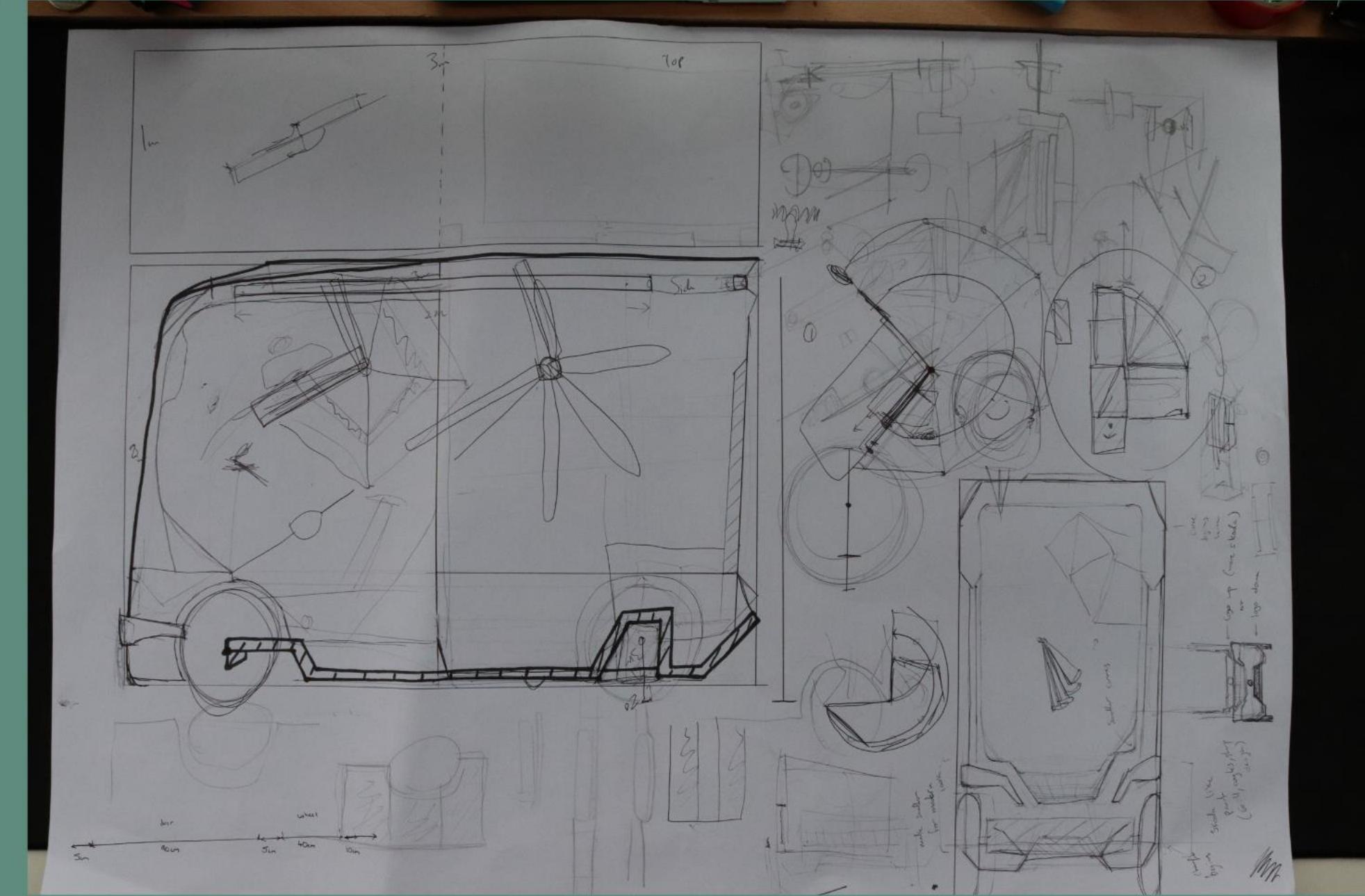
- Aluminum can corrode over time leading to weakness
- Can deform over time with repeated force
- The frame could get heavy if not designed well

Overall, Aluminum extrusion would be a great material to use for an EAV frame. It is simple to manufacture and can be formed into the required shape easily.



Appendix

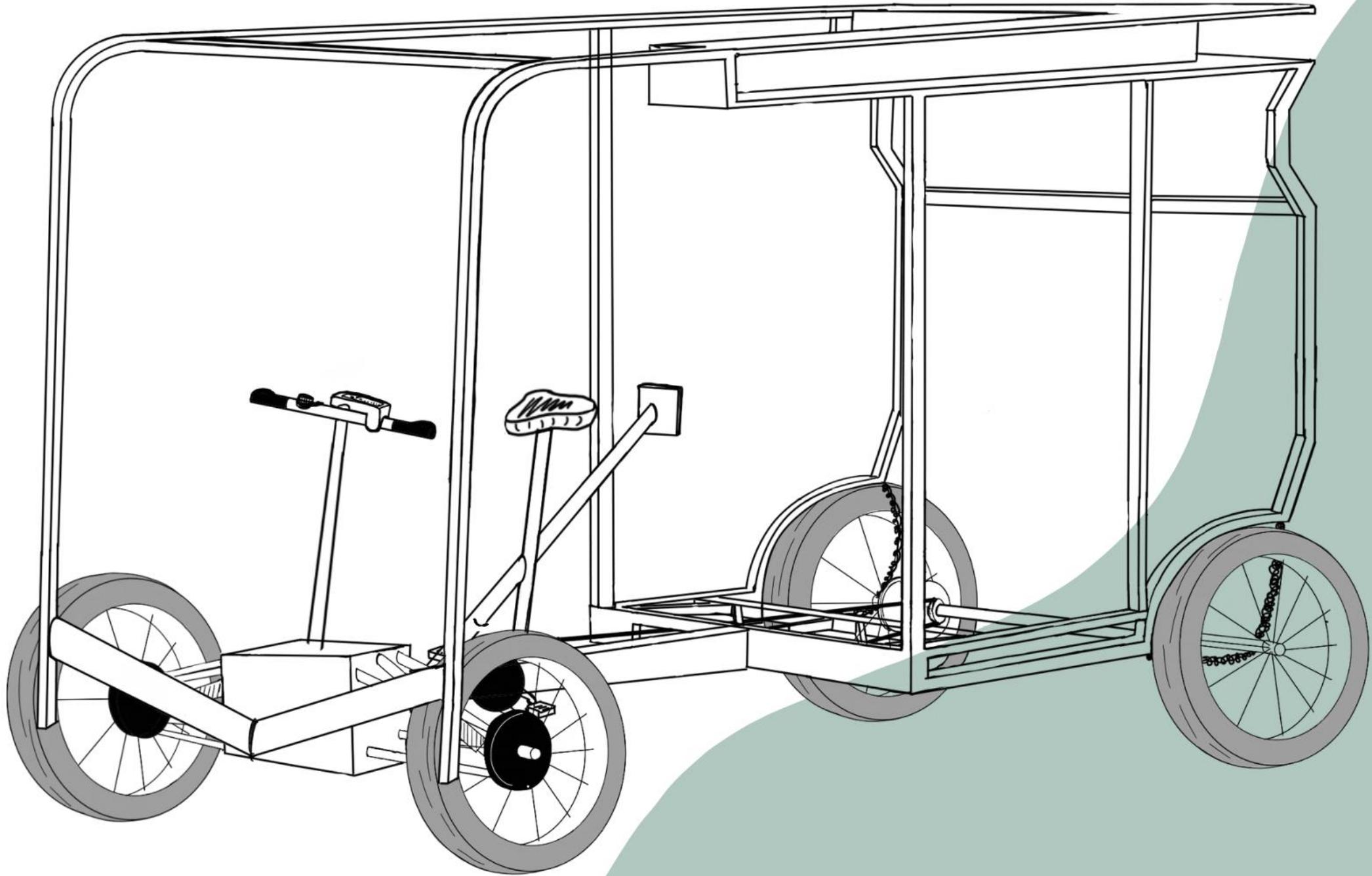
Group 5



Chassis Design Refinement

Lily Butler

Concept
Refinement



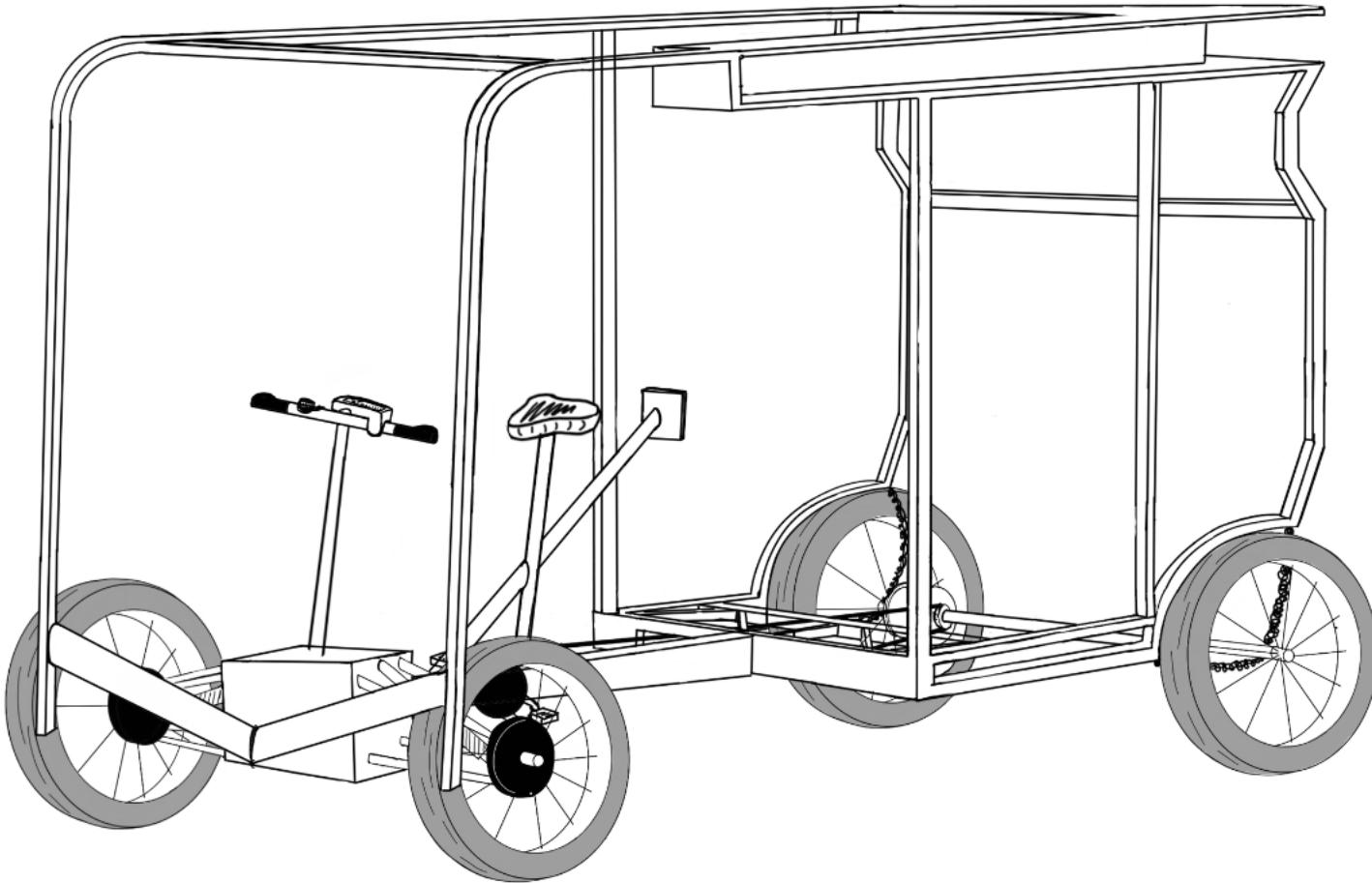
Chassis Design Refinement

Concept
Refinement

Lily Butler

Refinements:

- Thinner frame
- Less structure at the front to allow for easier steering
- Chassis supports the panels and creates the support for the awning
- Suspension added to the front and back axle
- Support for test box added
- Straight handle bars chosen
- Correct proportions allowing for accurate visuals of the suspension and steering mechanisms
- Frame cuts in at the back to allow for more creative flare in the corners of the outer panels



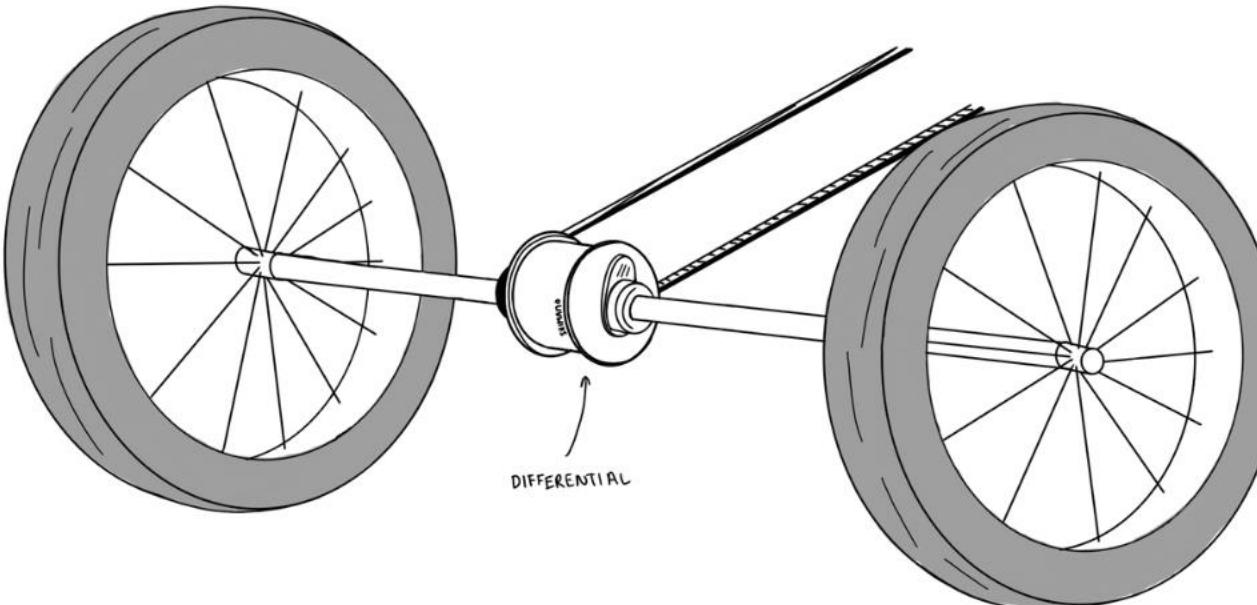
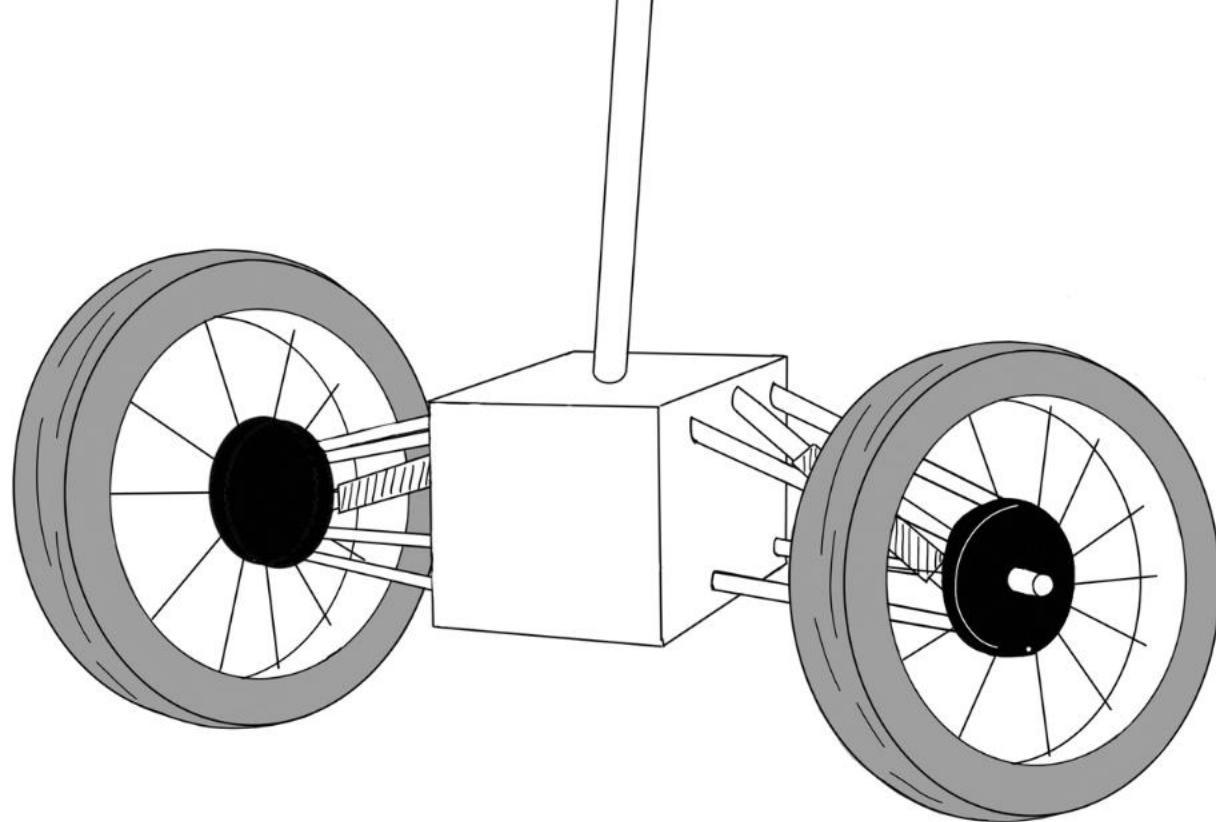
Chassis Design Refinement

Concept
Refinement

Lily Butler

Refinements:

- Front suspension around a central box connected directly to the handlebar support
- Sprung pistons add the suspension and the bars control the direction



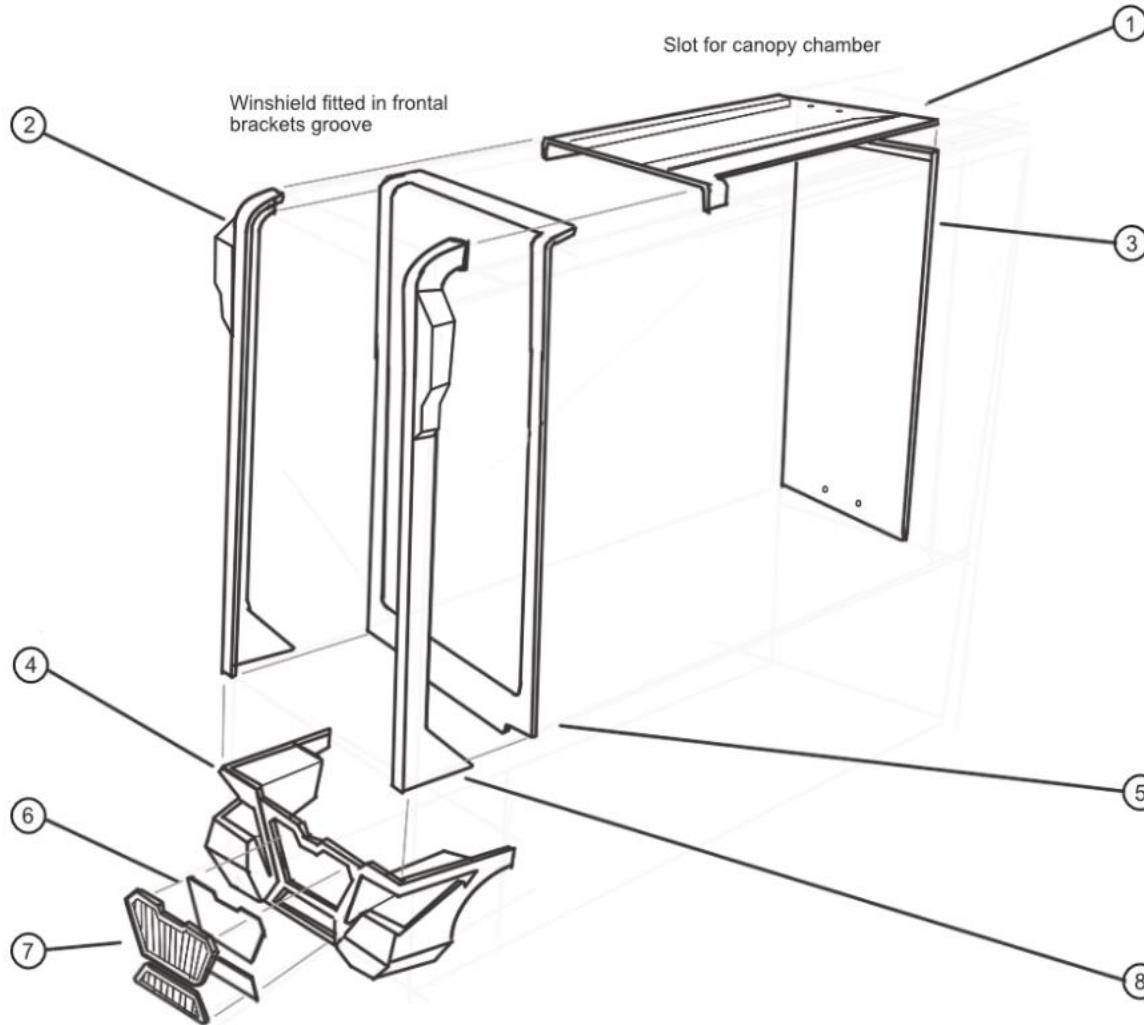
- Back suspension shown in full chassis drawing. Large springs allow wheels to move up and down within a limited distance
- Shimano differential allows wheels to be both driven by the gear box using a belt drive, and also able to move at different speeds.



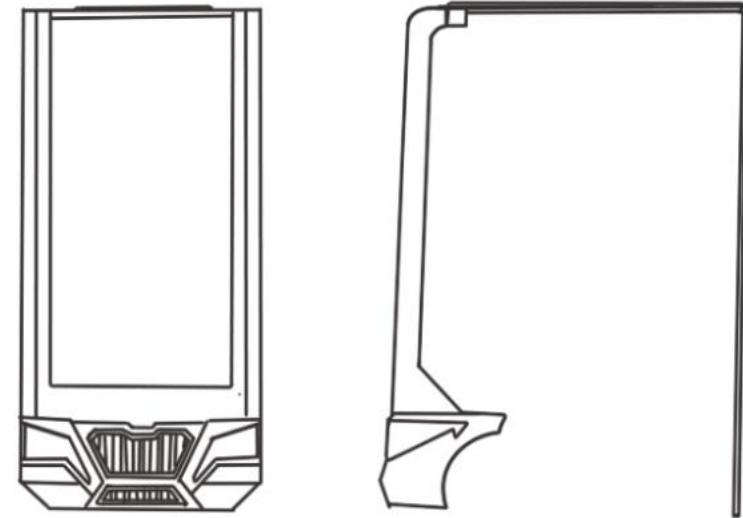
TECHNICAL DISCOVERY

Front Exterior Body Discovery

Mohammed Musa



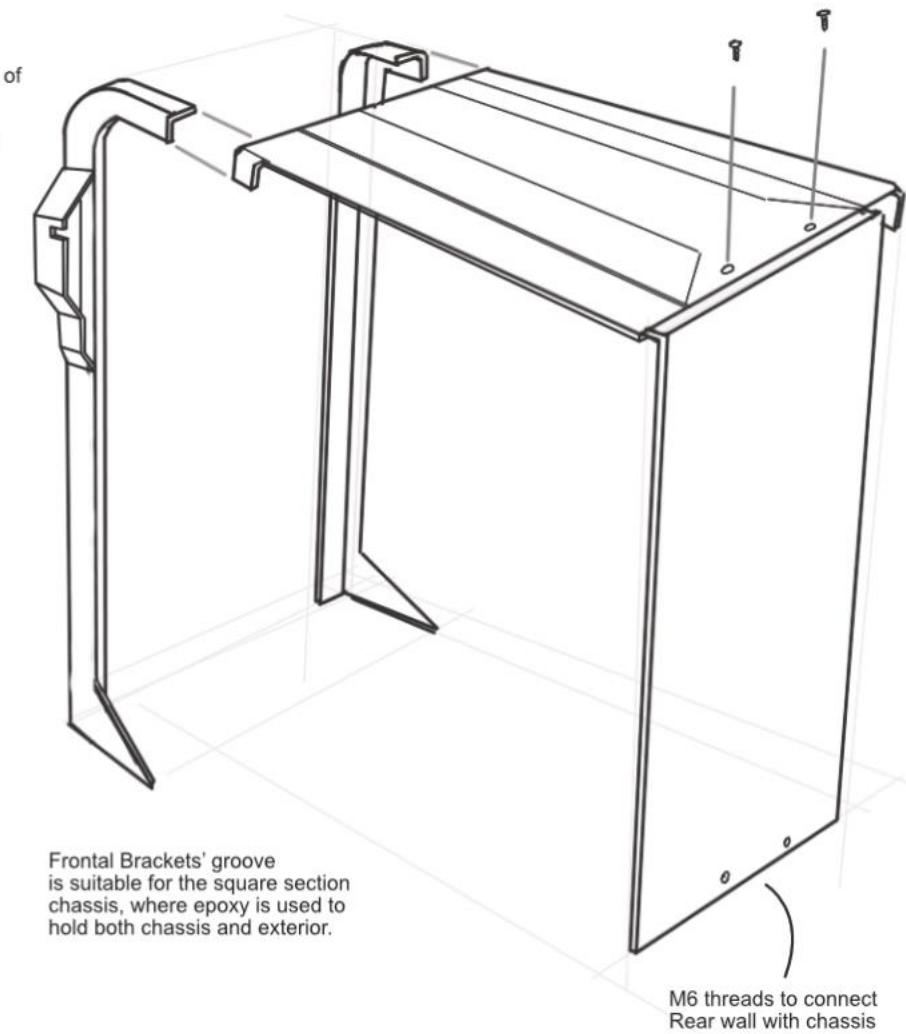
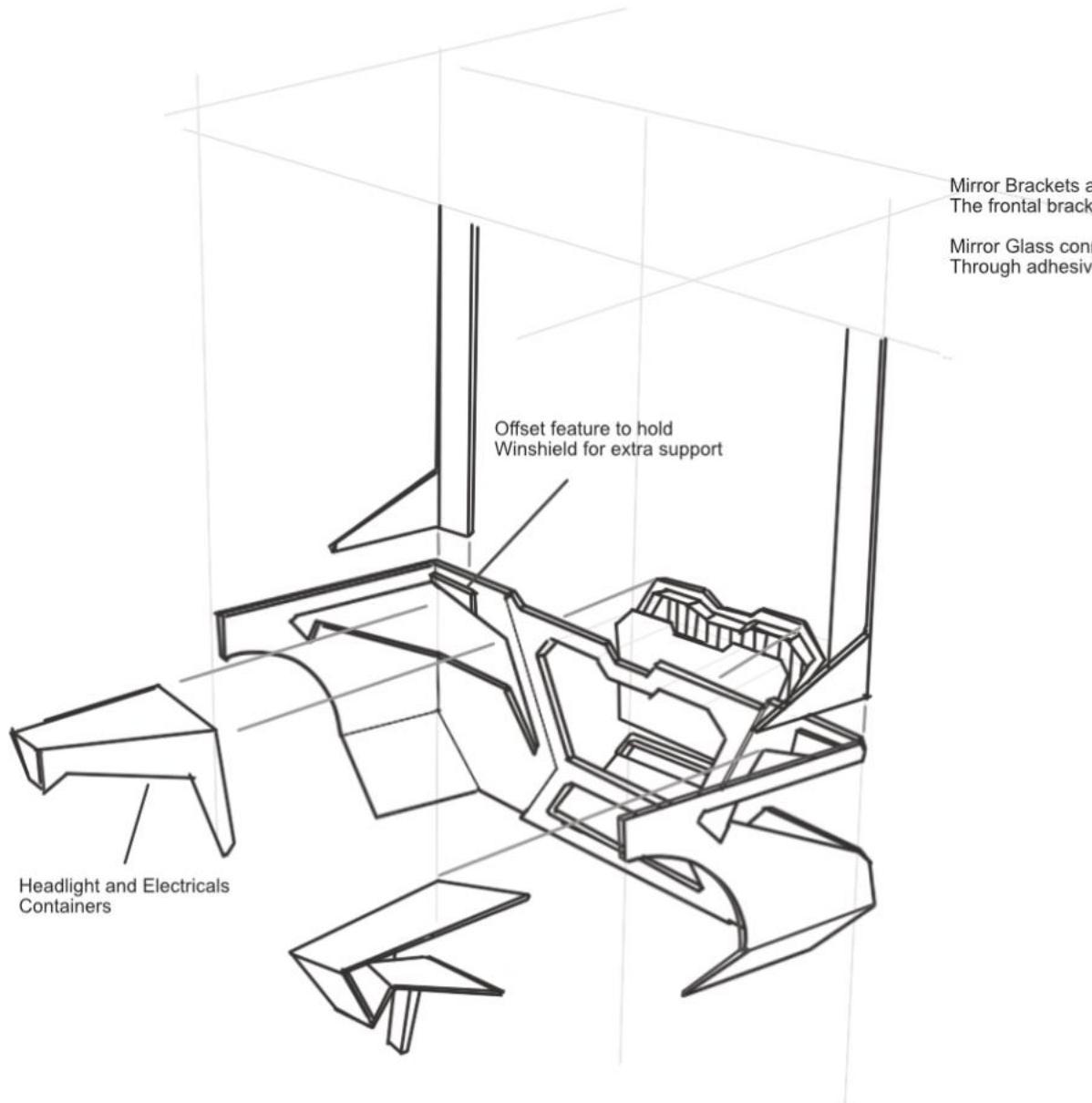
*All parts are joined through the use of adhesive as the main material is Carbon fibre instead of a metal like Aluminum which requires welding.



No.	Part	Material	Method	Quantity
1	Roof	Carbon Fibre	Layup-process	1
2	Right Frontal Bracket	Carbon Fibre	Layup-process	1
3	Rear Wall	Carbon Fibre	Layup-process	1
4	EAV Front	Carbon Fibre	Layup-process	1
5	Windshield	Laminated Glass	Glass Cutting	1
6	Grille Seal	ABS	Injection Moulding	1
7	Grille	ABS	Injection Moulding	1
8	Left Frontal Bracket	Carbon Fibre	Layup-process	1

Front Exterior Body Discovery

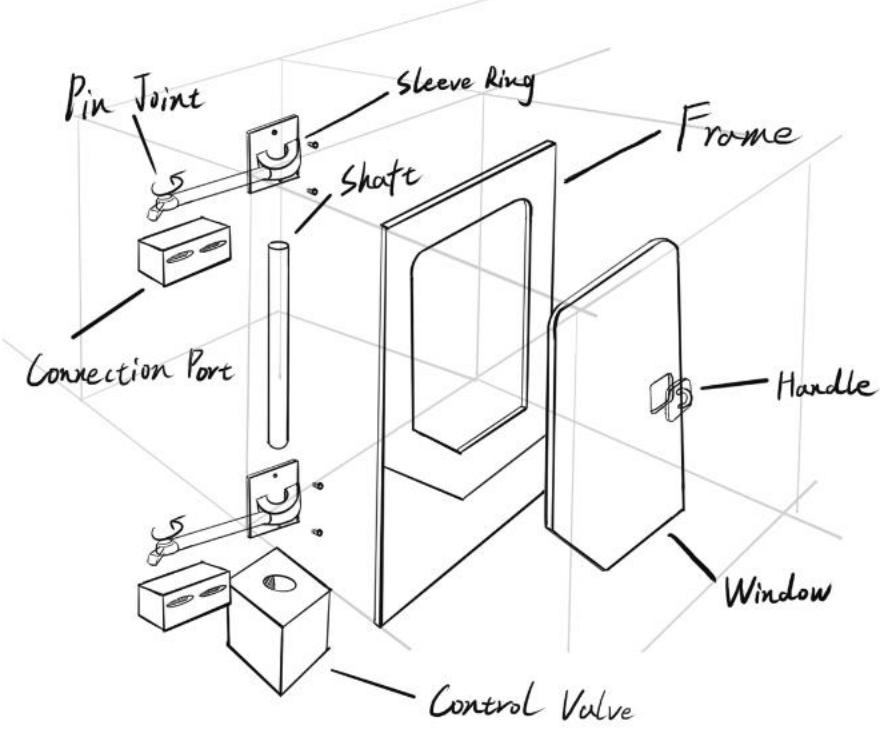
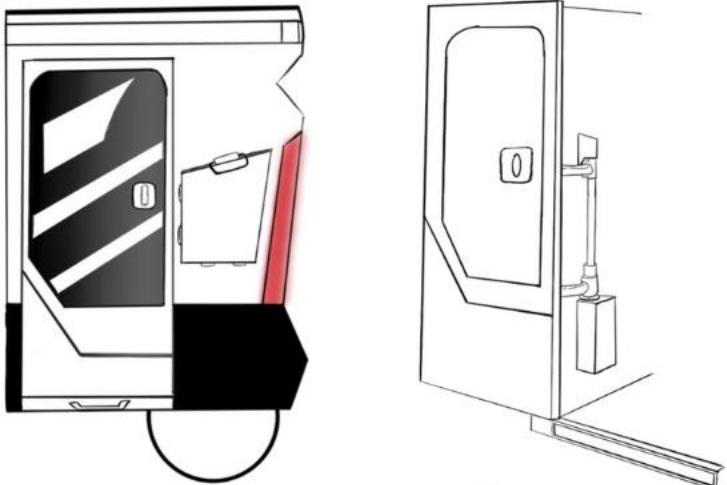
Mohammed Musa



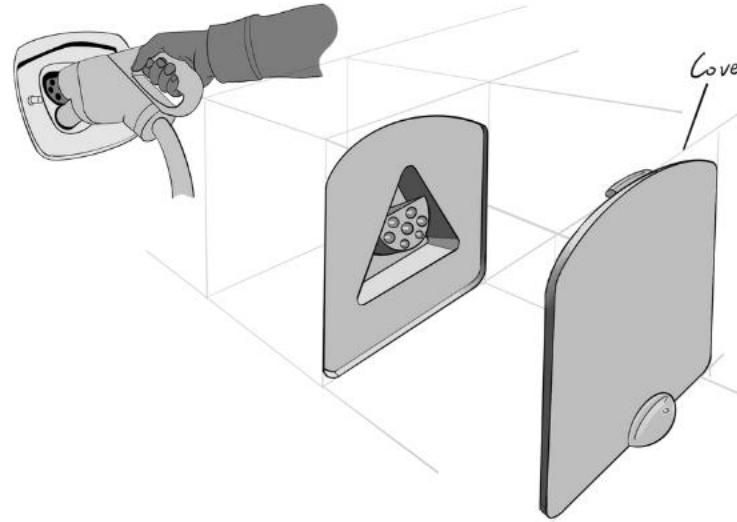
Rear Exterior Body Discovery

Jiashu Huang

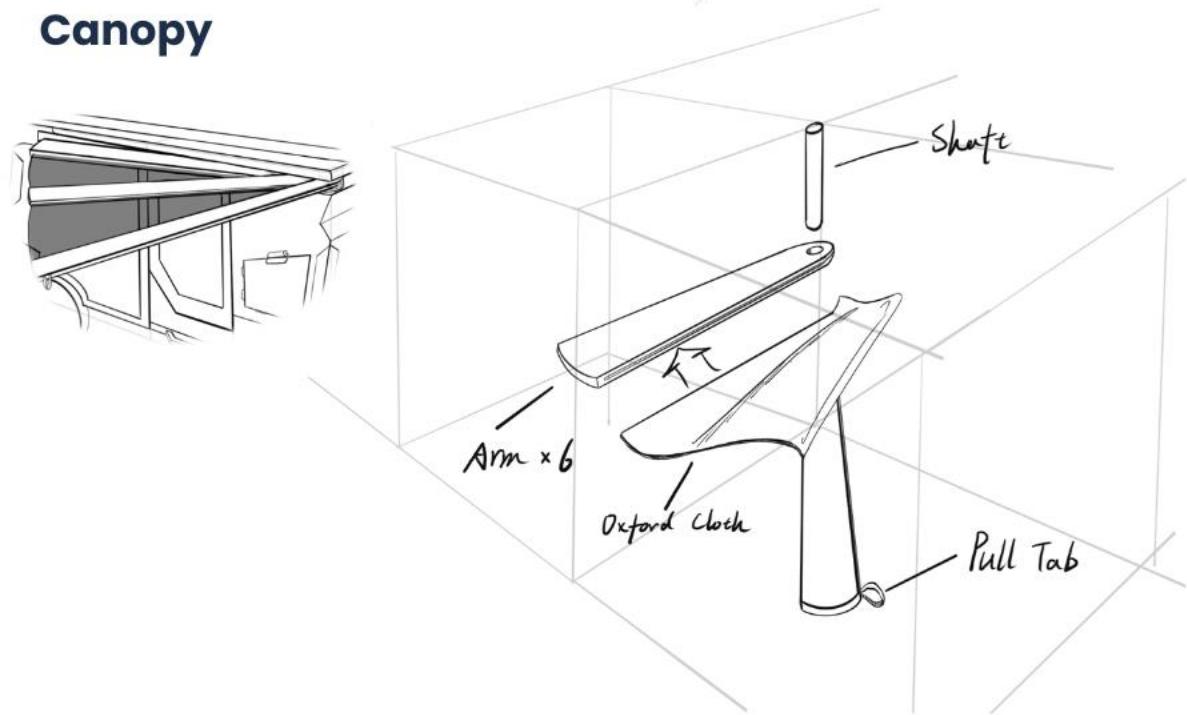
Side Door



Socket



Canopy

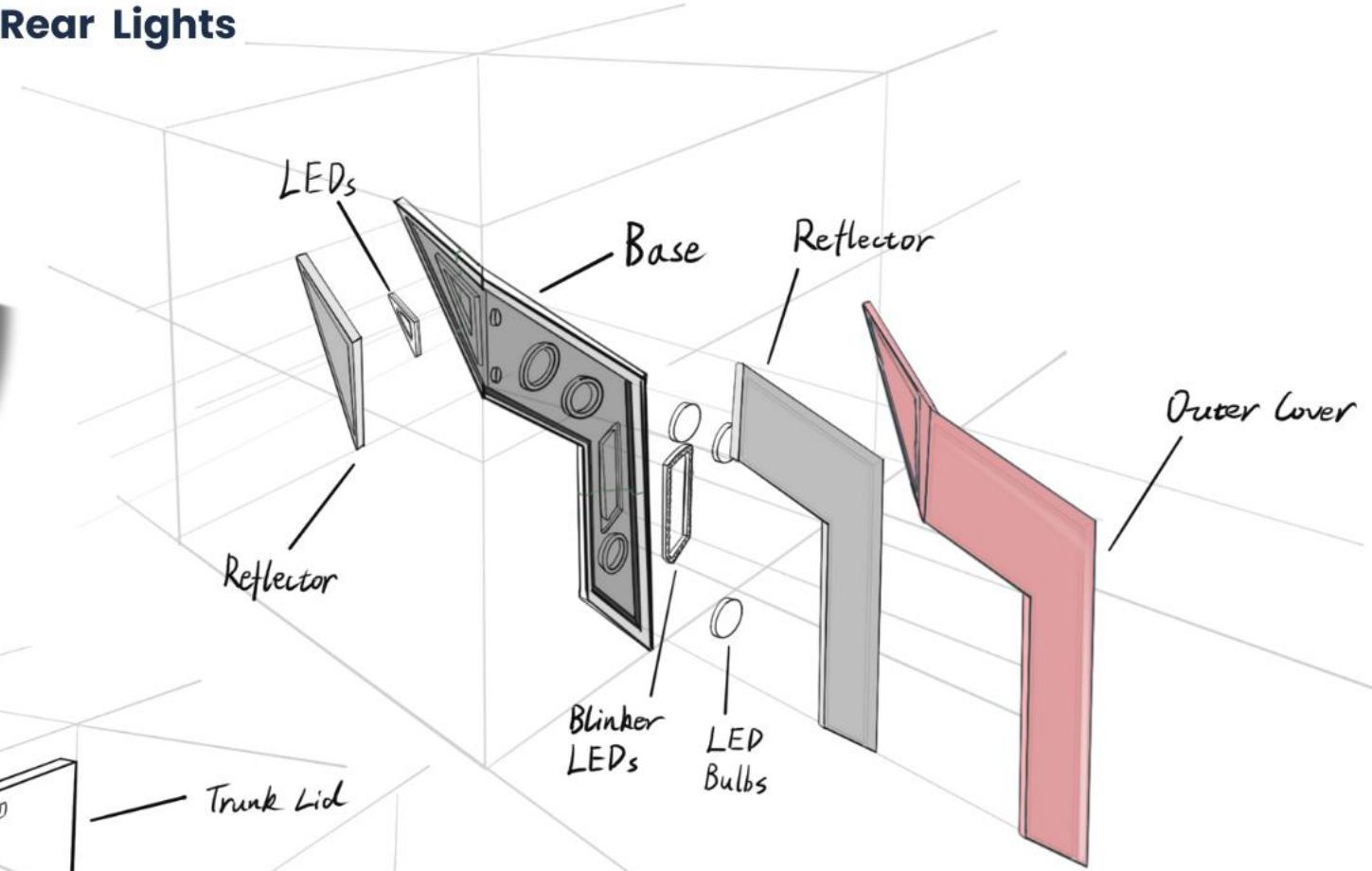


Rear Exterior Body Discovery

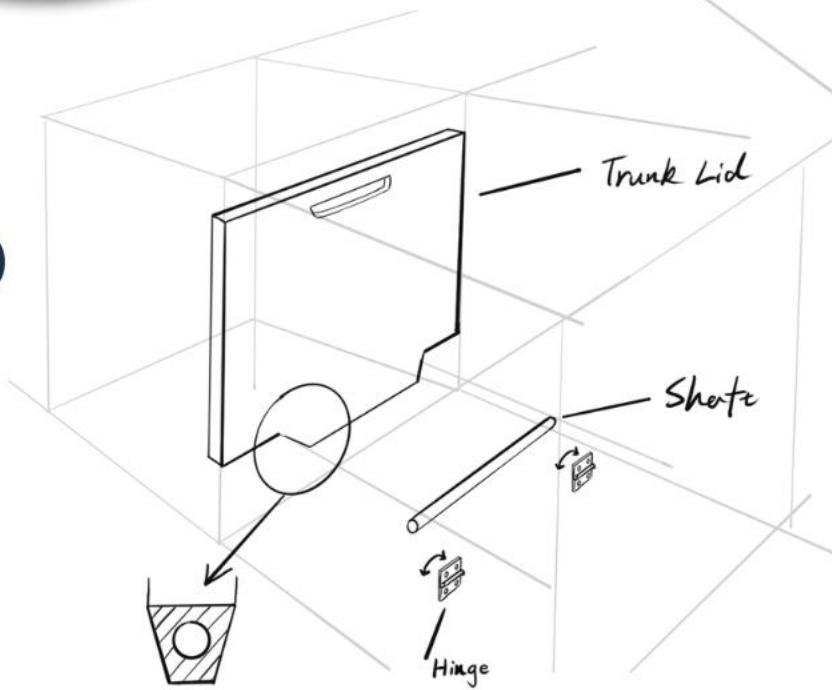
jiashu Huang



Rear Lights

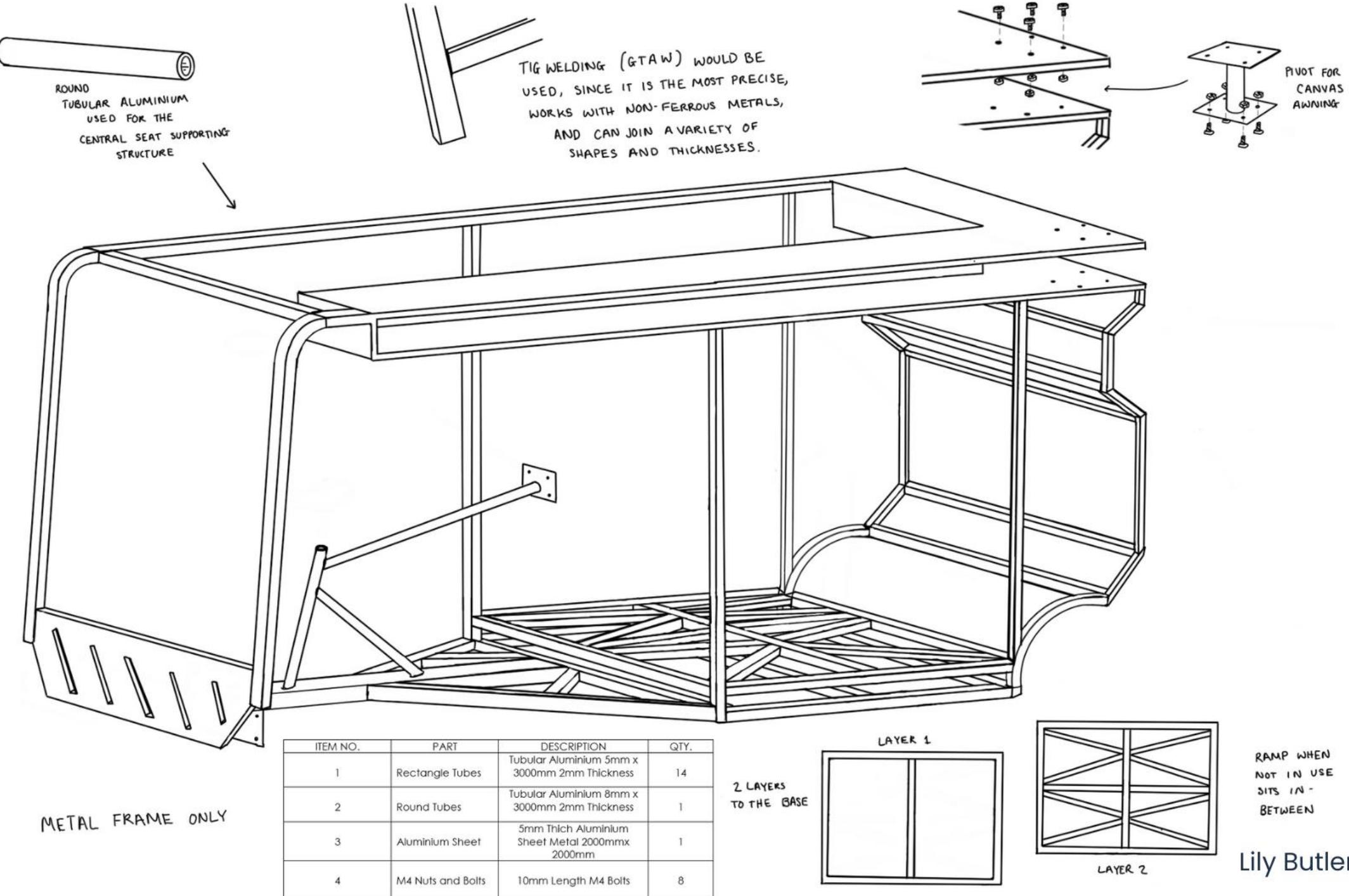


Rear Door (Storage Door)



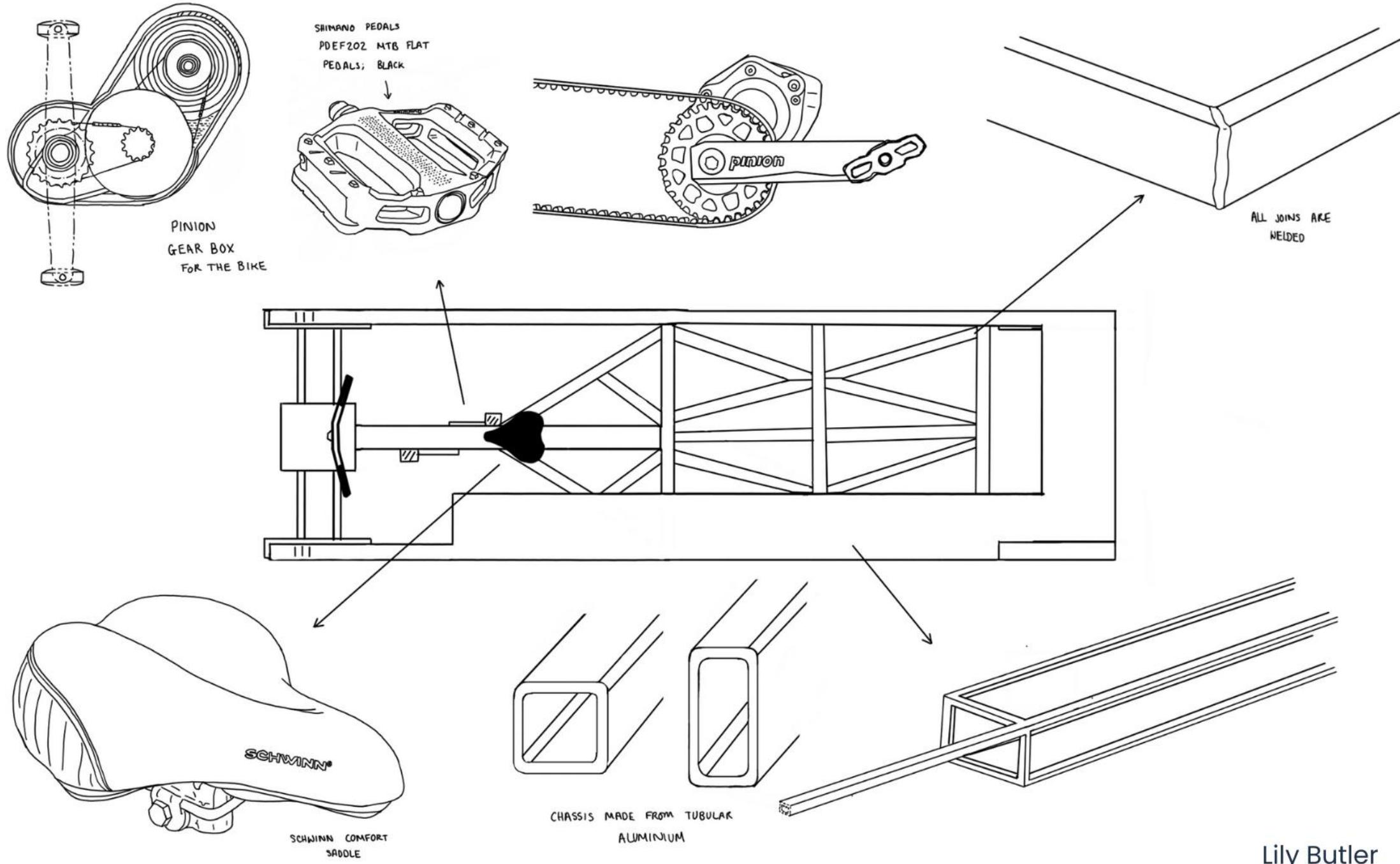
Chassis Design Technical Discovery

Dominic Brown and Lily Butler



Chassis Design Technical Discovery

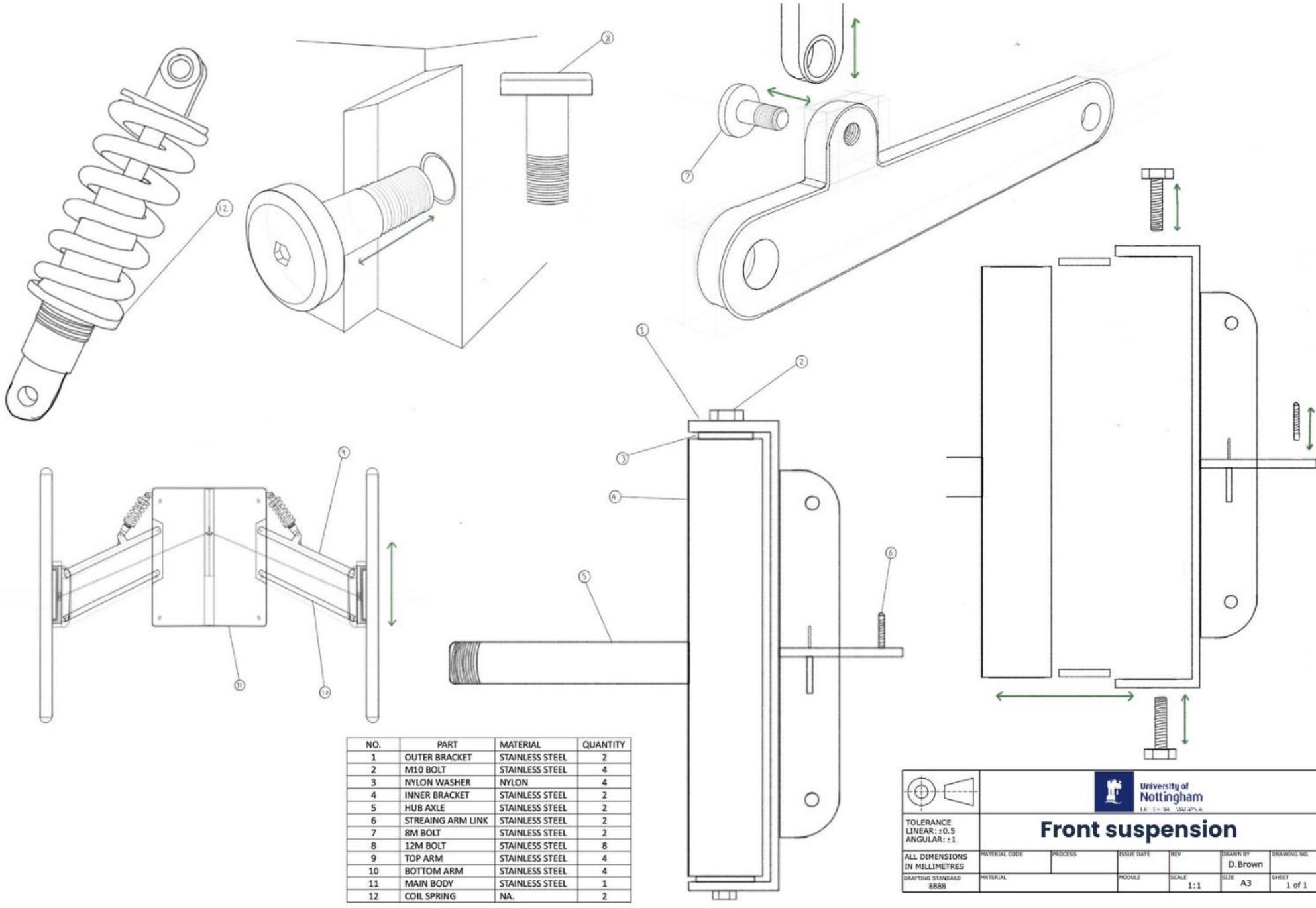
Dominic Brown and Lily Butler



Lily Butler

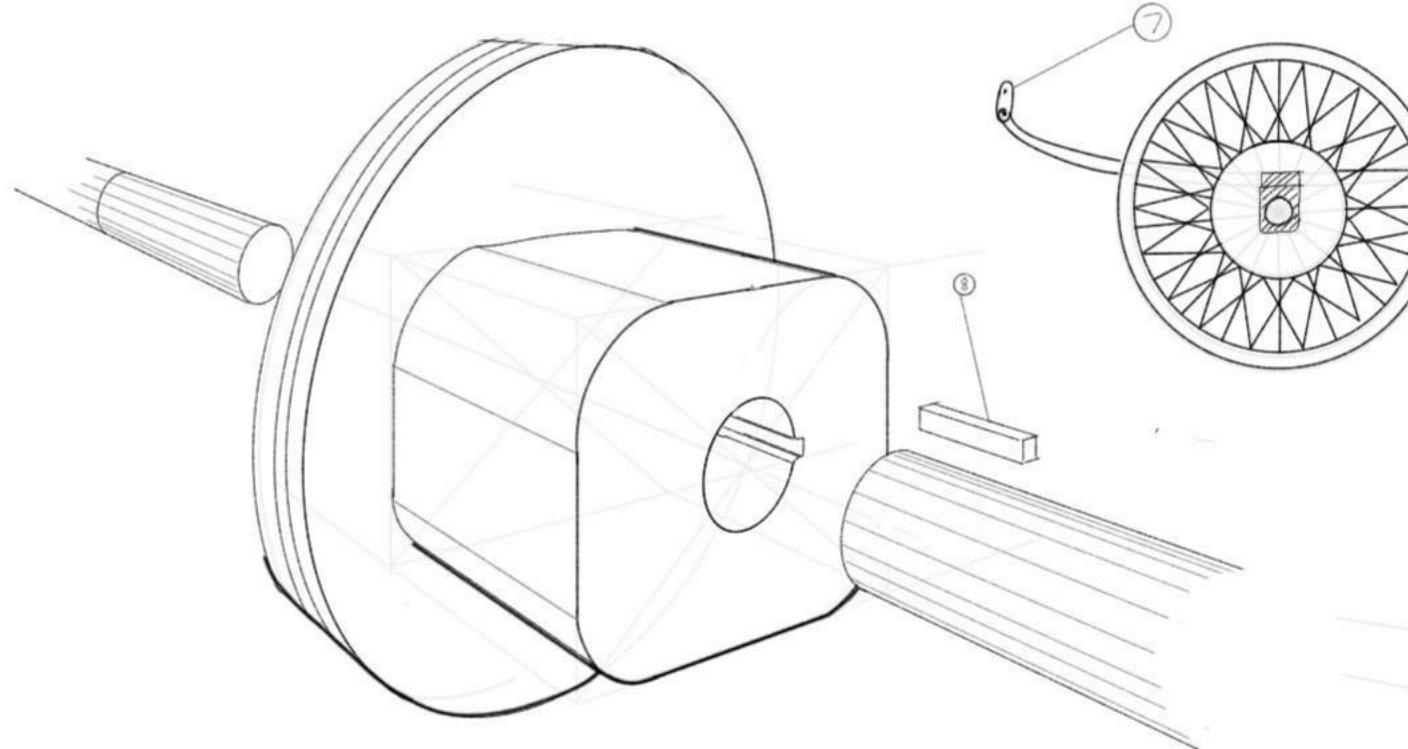
Chassis Design Technical Discovery

Dominic Brown and Lily Butler

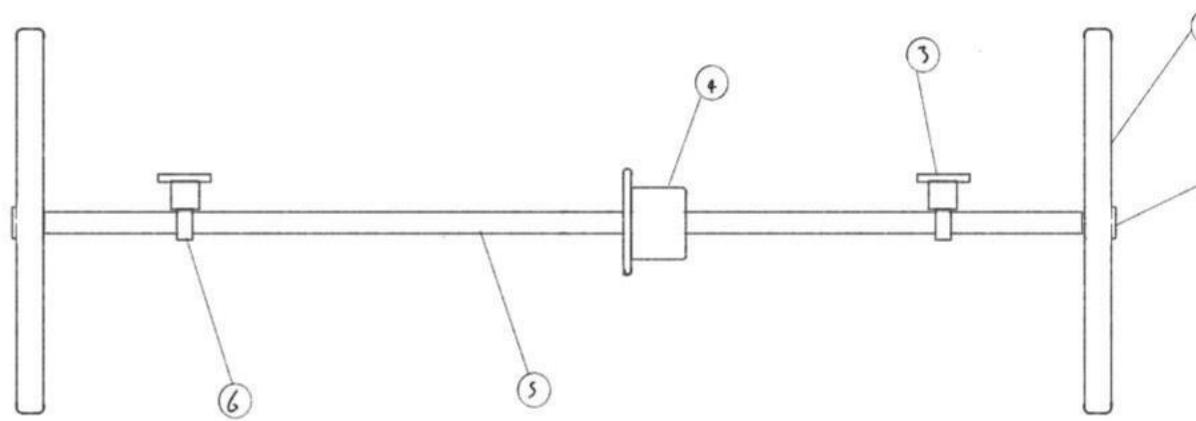
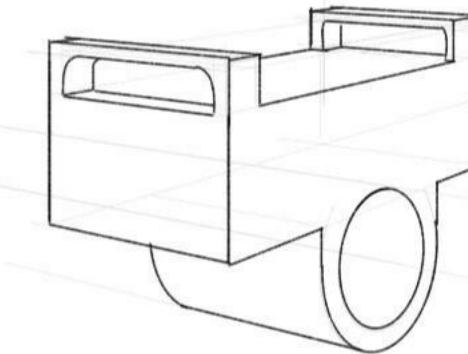


Chassis Design Technical Discovery

Dominic Brown and Lily Butler



NO.	PART	MATERIAL	QUANTITY
1	DRIVE WHEEL	NA.	2
2	WHEEL HUB	STAINLESS STEEL	2
3	LEAF SPRING	SPRING STEEL	2
4	DIFFERENTIAL	NA.	1
5	AXLE	STAINLESS STEEL	2
6	LEAFSPRING HOLDER	STAINLESS STEEL	2
7	SPRING CLIP	STAINLESS STEEL	4
8	KEY	STAINLESS STEEL	4



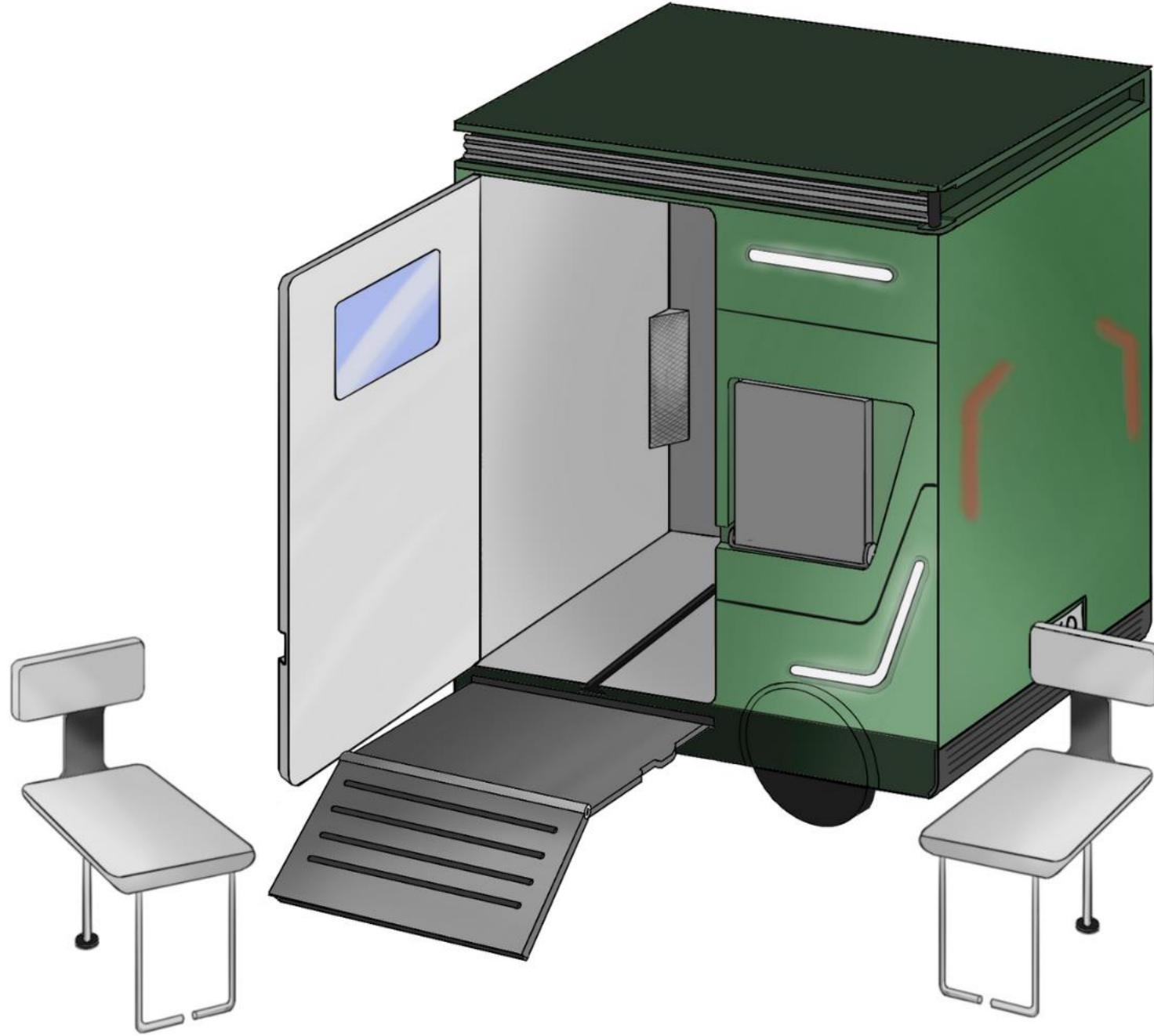
University of Nottingham
1:1 = 14.324mm A

TOLERANCE LINEAR: ±0.5 ANGULAR: ±1	REAR suspension				
ALL DIMENSIONS IN MILLIMETRES	MATERIAL CODE	PROCESS	ISSUE DATE	REV	DRAWN BY D.Brown
DRAFTING STANDARD 8888	MATERIAL		MODULE	SCALE 1:1	SIZE A3
					SHEET 1 of 1

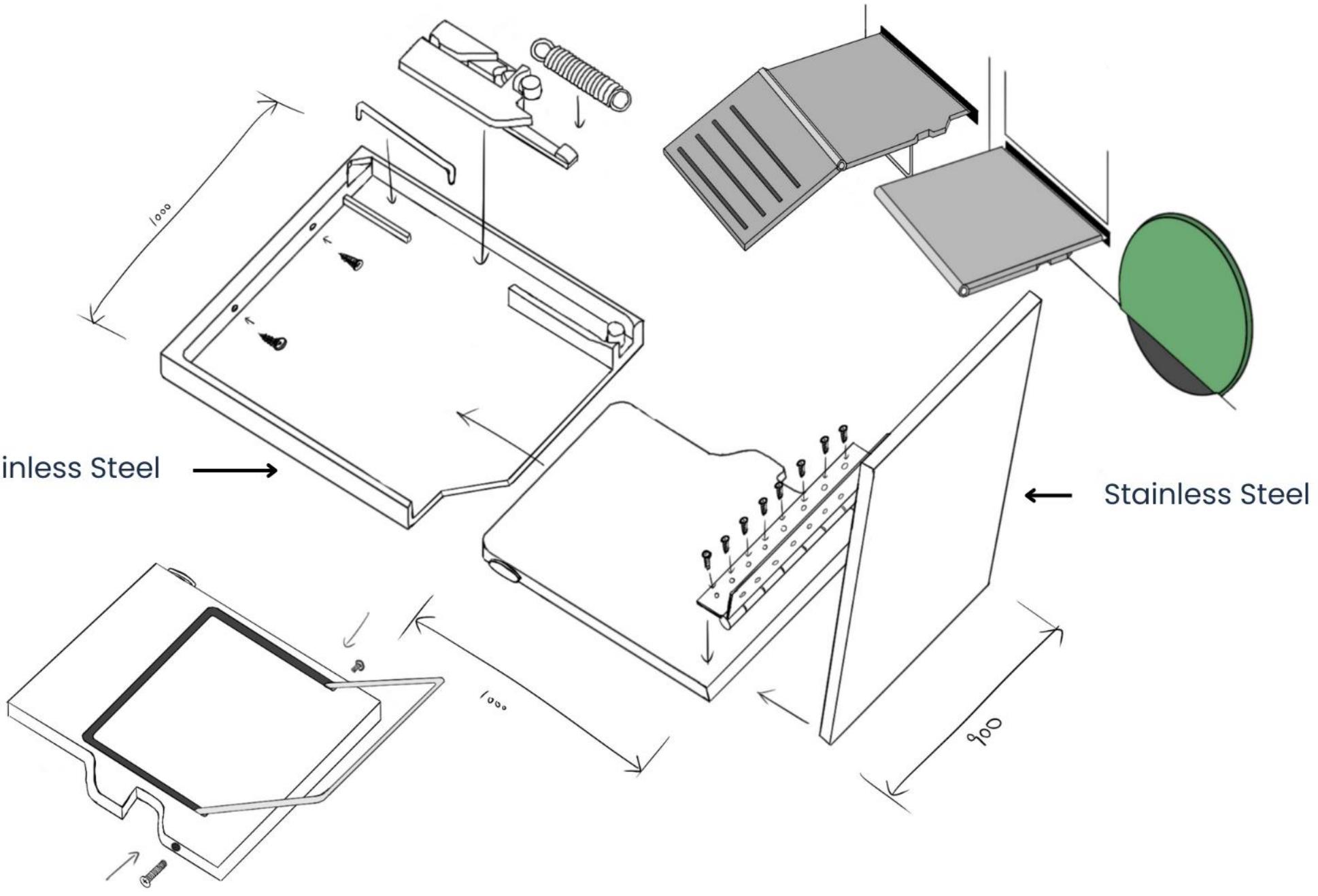
Medical Service Design Discovery

Qichenq Liu

2D rendering



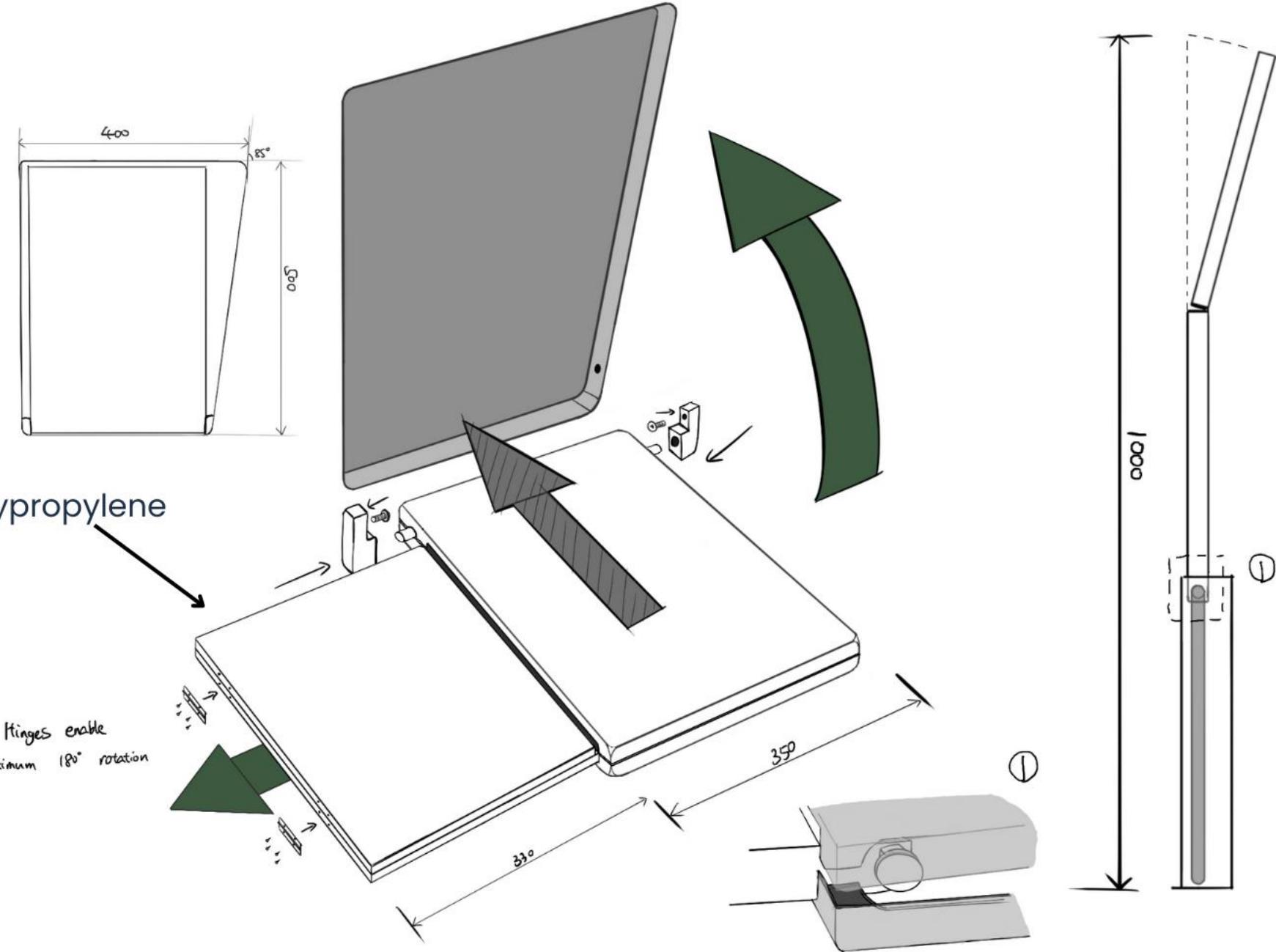
Technical Discovery on ramp



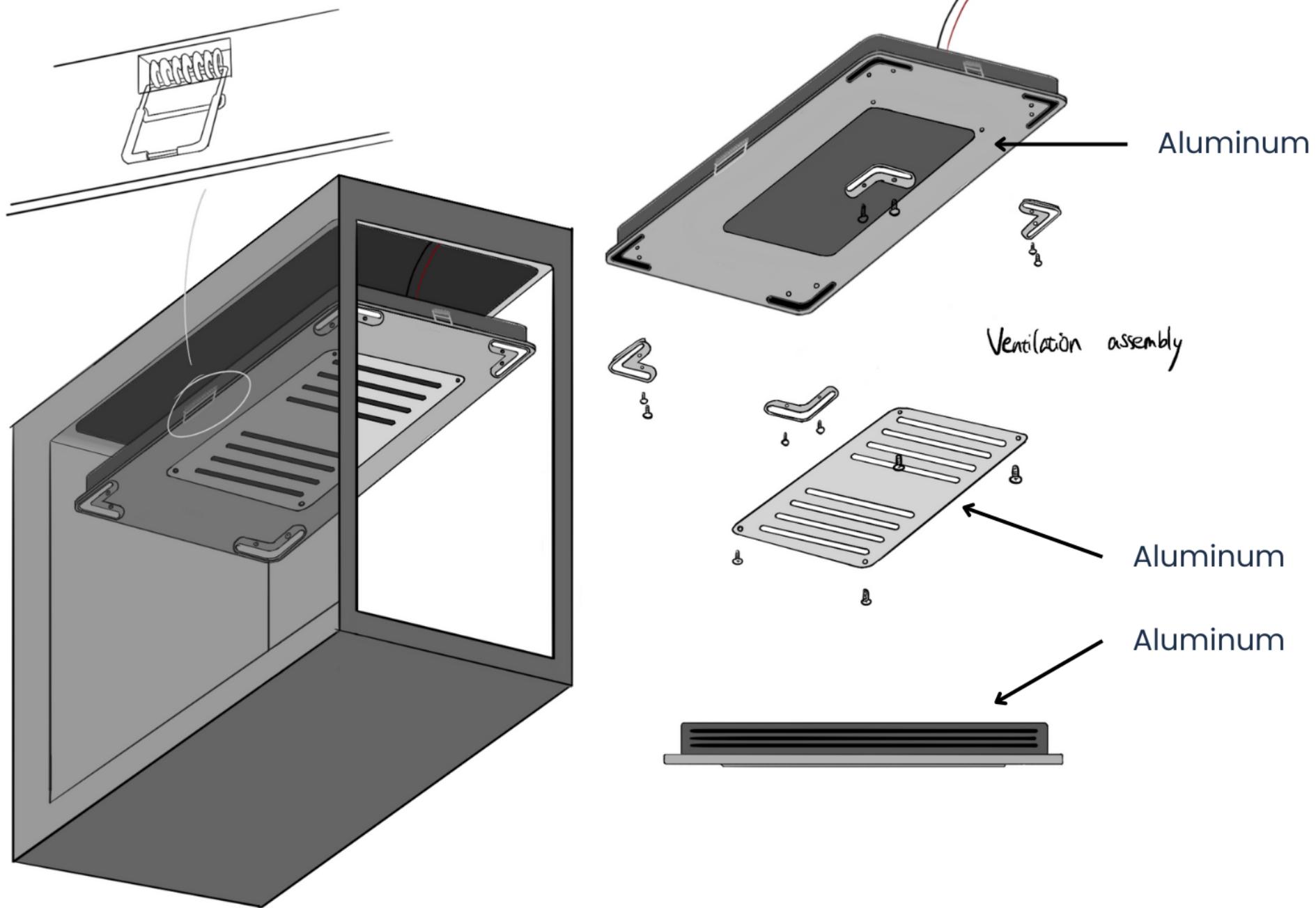
Medical Service Design Discovery

Qichenq Liu

Technical Discovery on foldable table



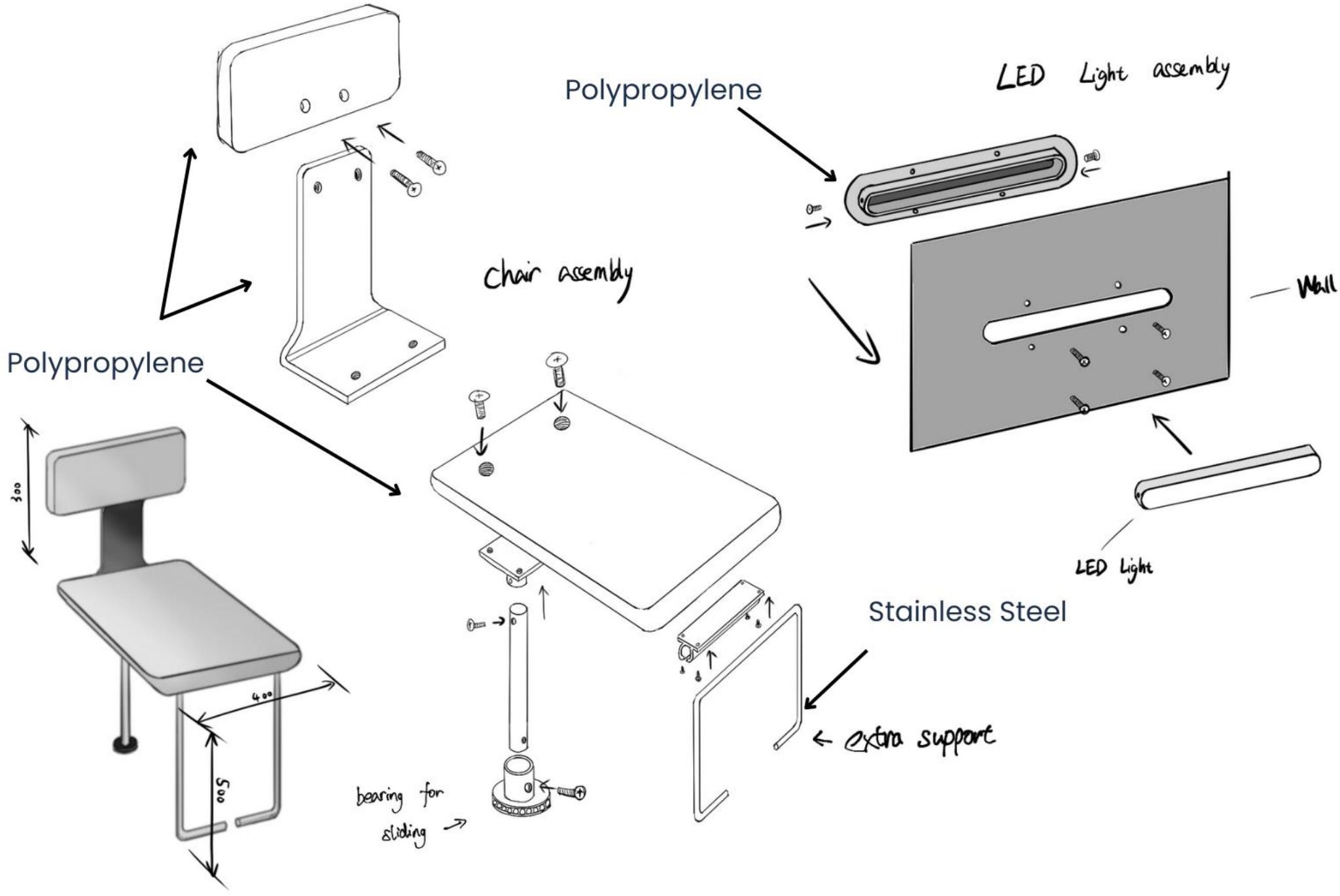
Technical Discovery on ventilation & lighting



Medical Service Design Discovery

Qicheng Liu

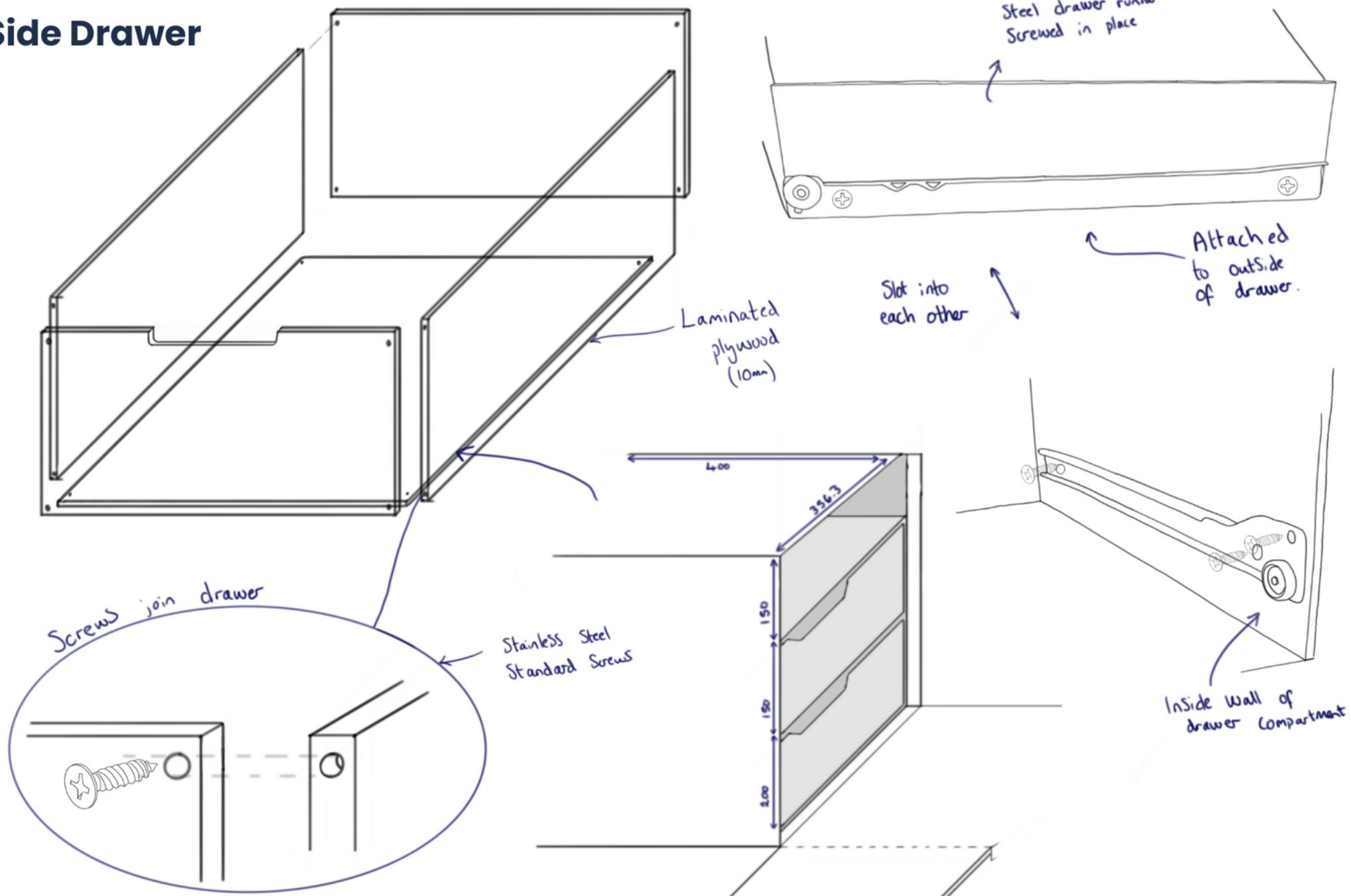
Technical Discovery on sliding chair



Medical Service Design Discovery

Eleanor Webster

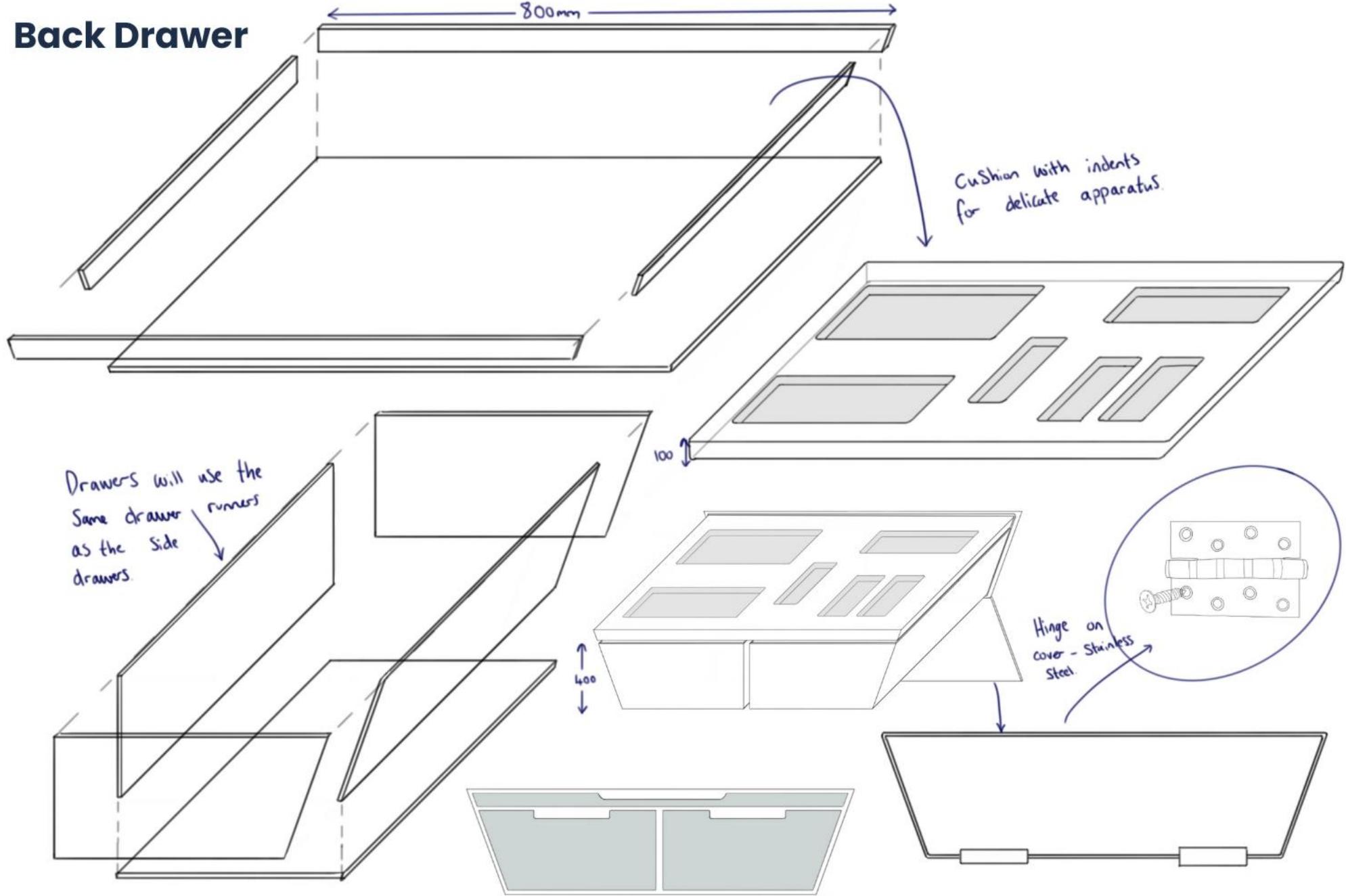
Side Drawer



Medical Service Design Discovery

Eleanor Webster

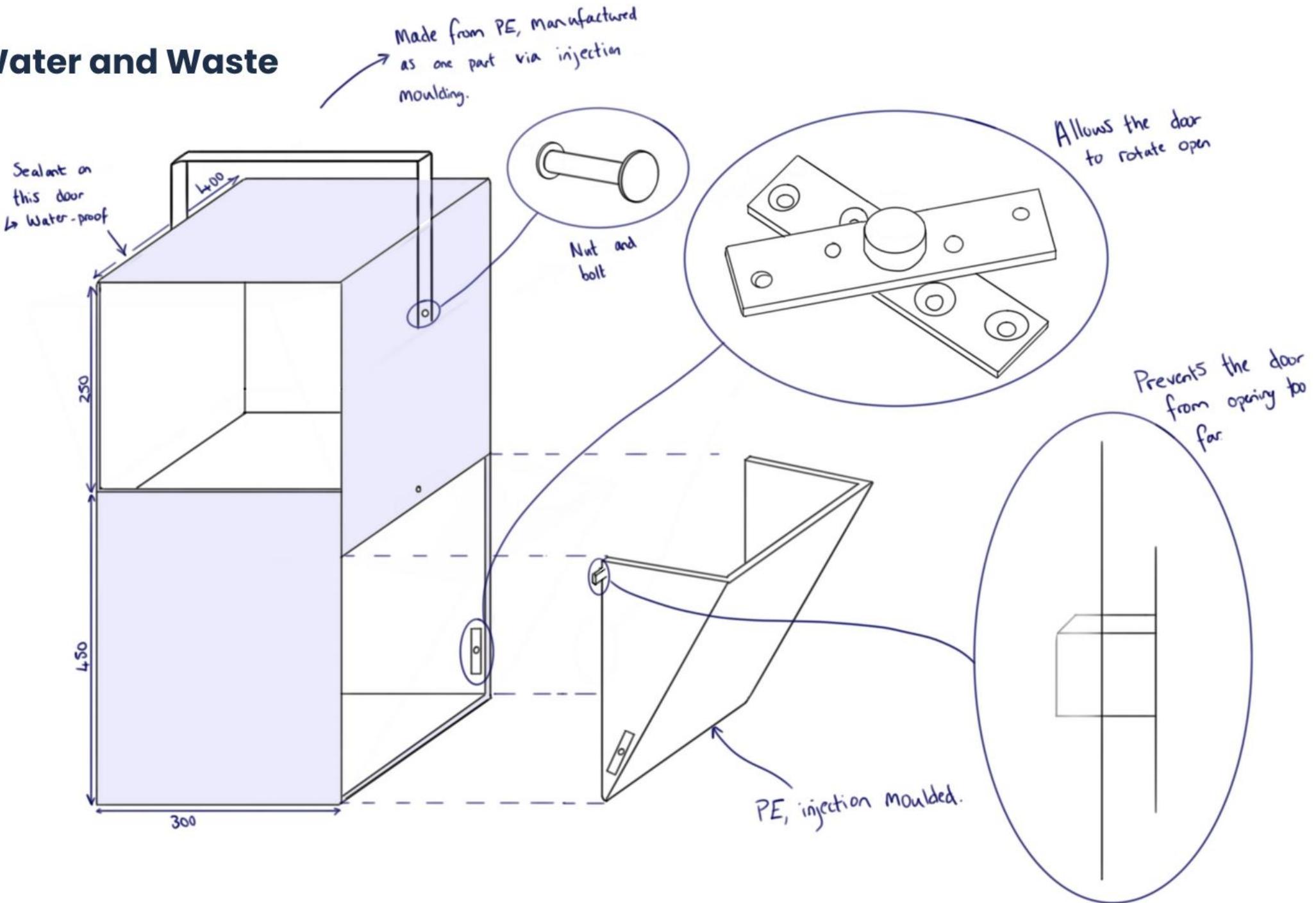
Back Drawer



Medical Service Design Discovery

Eleanor Webster

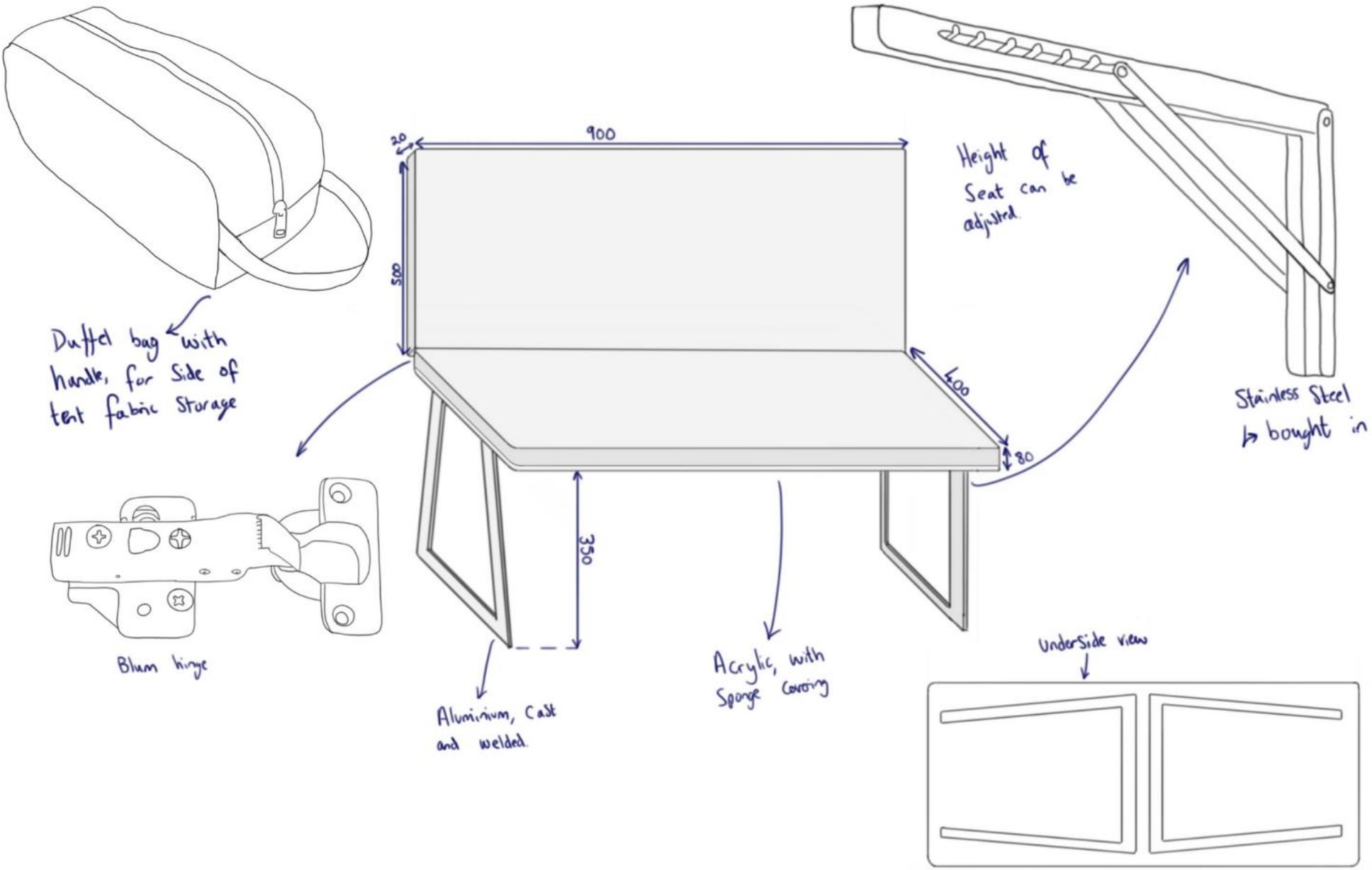
Water and Waste



Medical Service Design Discovery

Eleanor Webster

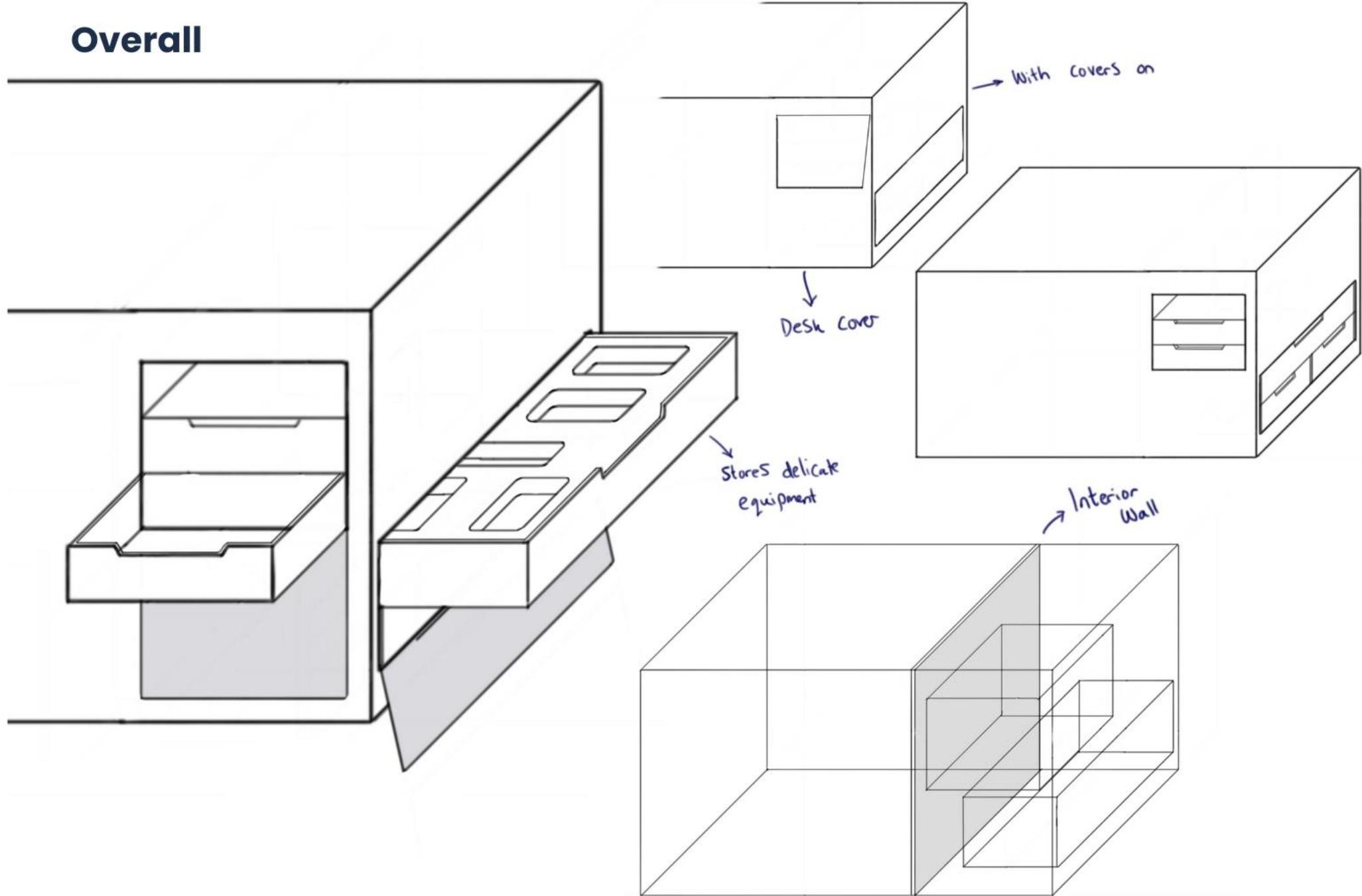
Waiting Area Chair and Awning Storage



Medical Service Design Discovery

Eleanor Webster

Overall





AUDIO



SKODA

Contents

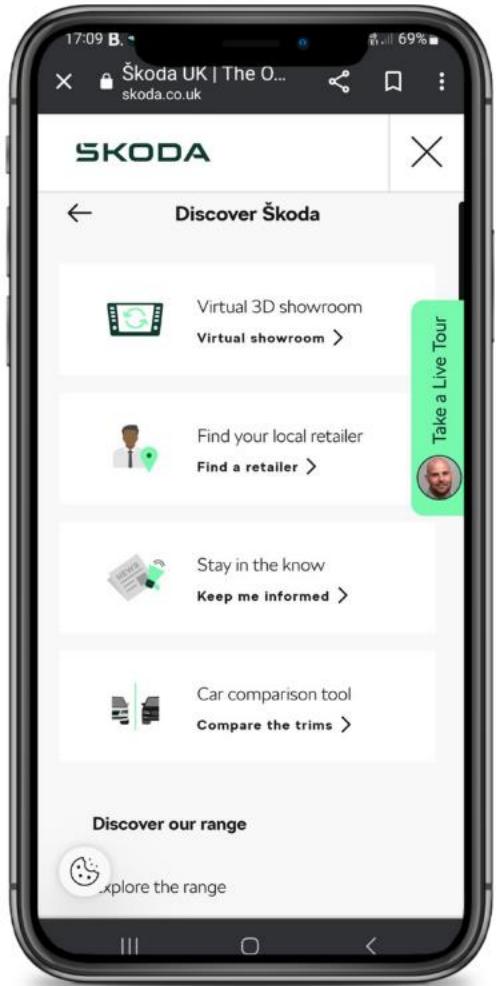
- SKODA
- Ideation & Concept Development
- Concept Refinement
- Technical Discovery
- Final Product

The background features a series of concentric, wavy lines in light gray and white, creating a sense of motion and depth. These lines are positioned behind the word "SKODA".

SKODA

SKODA

We chose SKODA because they have a great reputation for producing reliable vehicles and their image is very "environmentally friendly" due to their distinctive green colour theme.

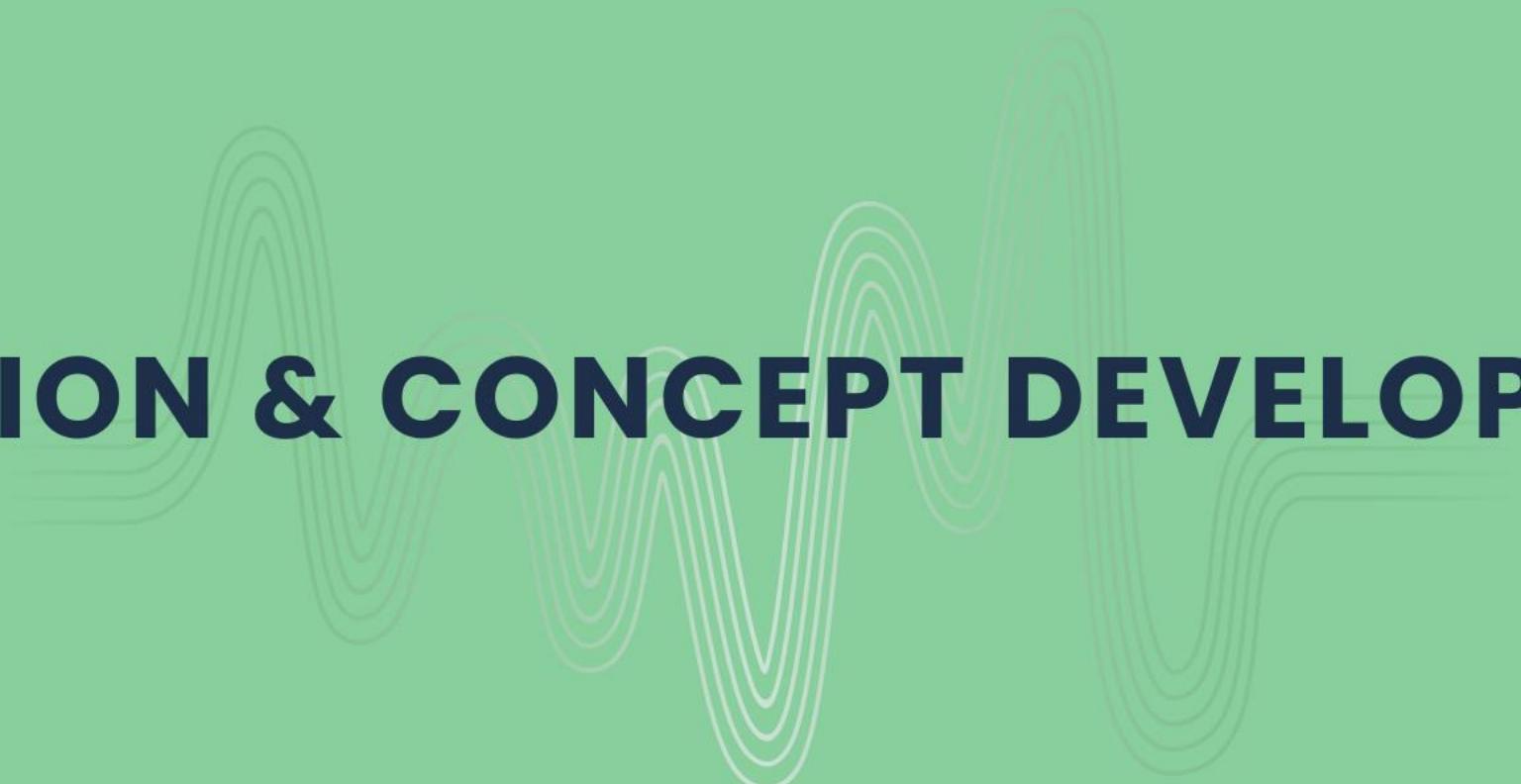


Whilst SKODA are best known for their huge variety of quality cars, in more recent years they have branched out into electric bikes, particularly those used for off-road journeys, for example:

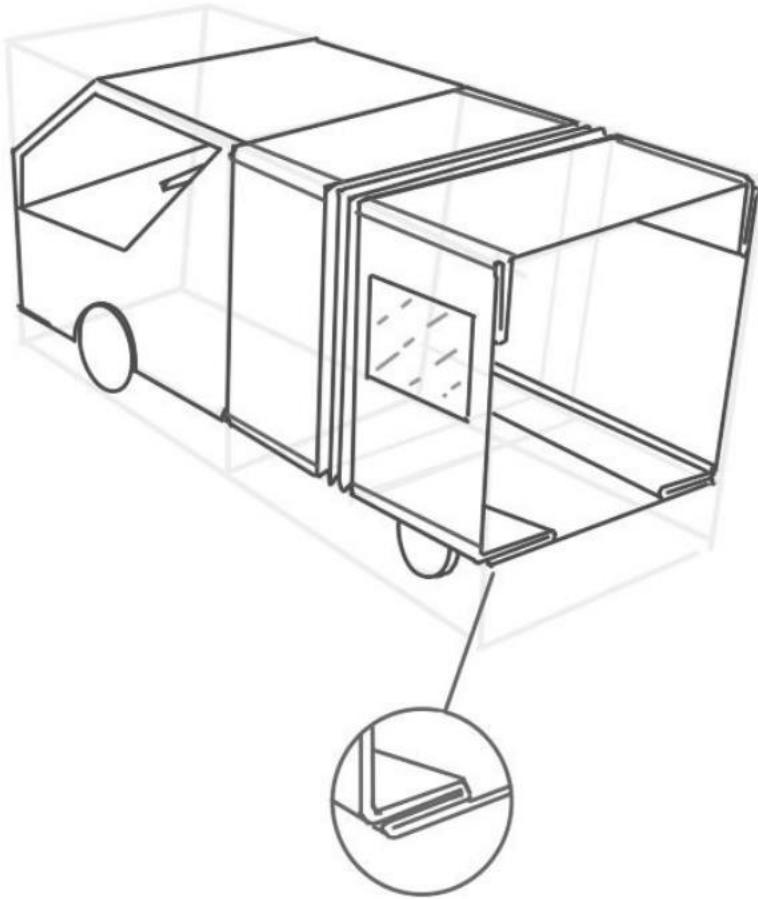
This image is from SKODA's 2019 collection.



IDEATION & CONCEPT DEVELOPMENT



Exterior Ideation

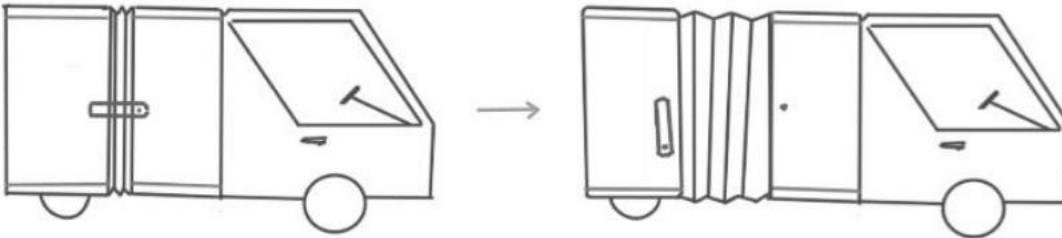


Inflatable Material:

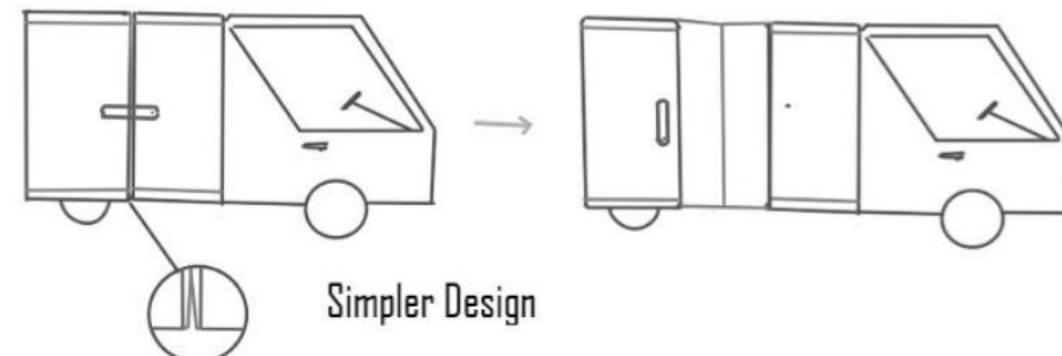
- Allows extensions from all directions

Skeleton

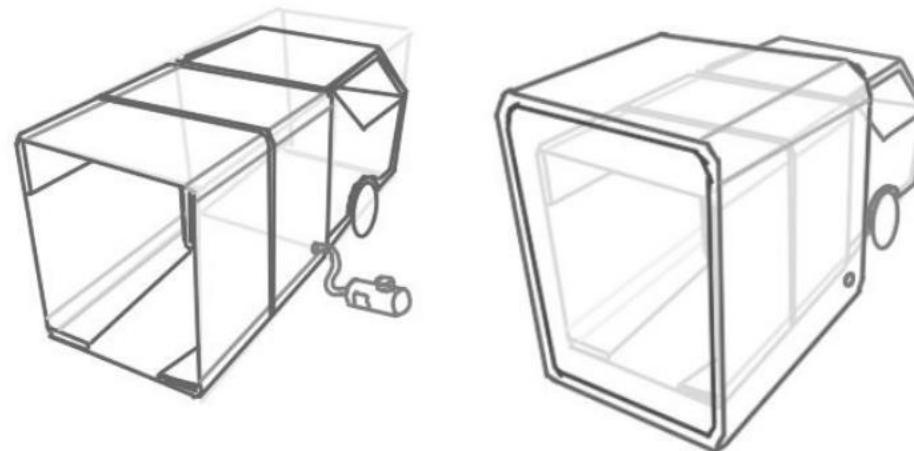
Interior Skeleton holds the cubic shape



Lock Mechanism

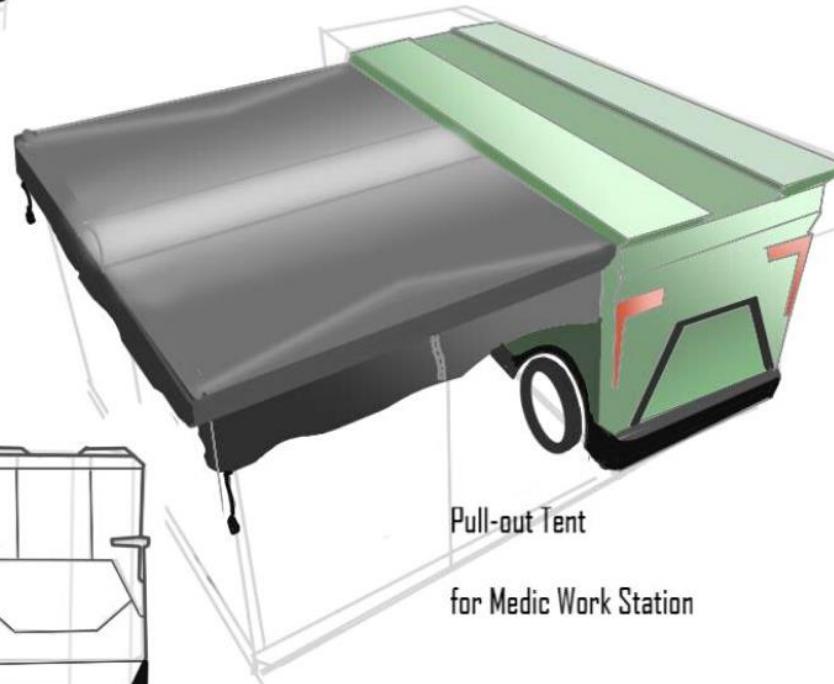
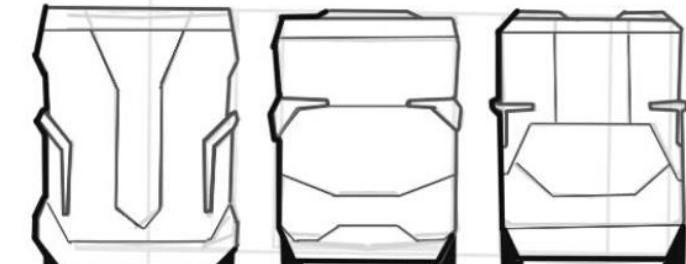


Simpler Design



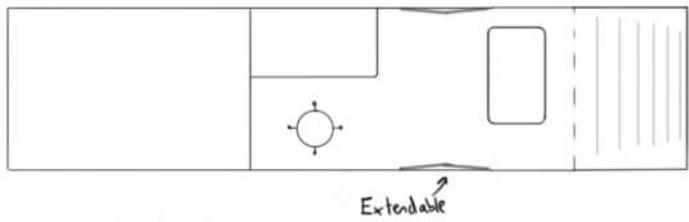
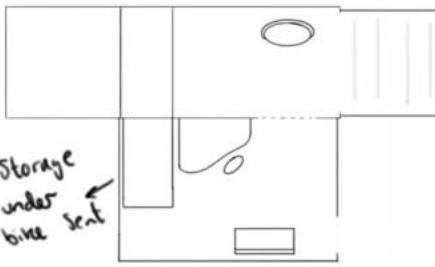
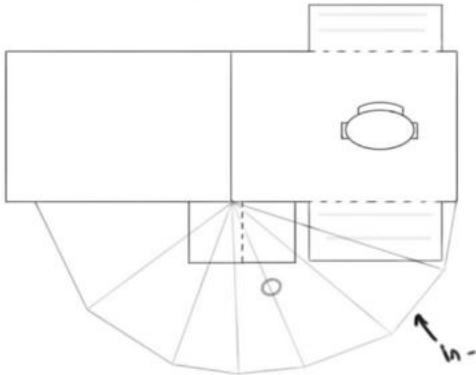
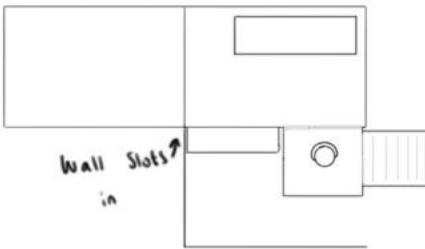
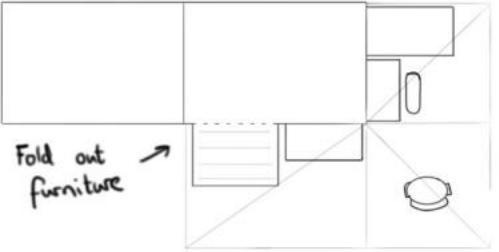
Exterior Ideation

Rear Concepts

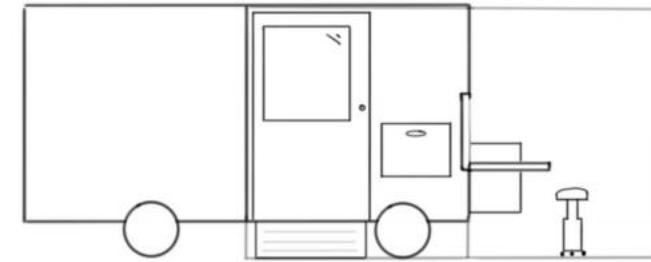
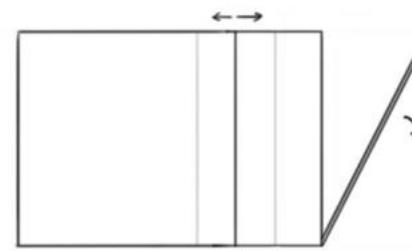
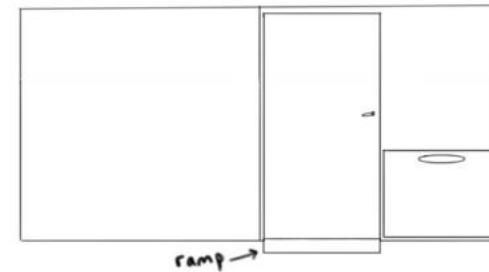


Interior Ideation

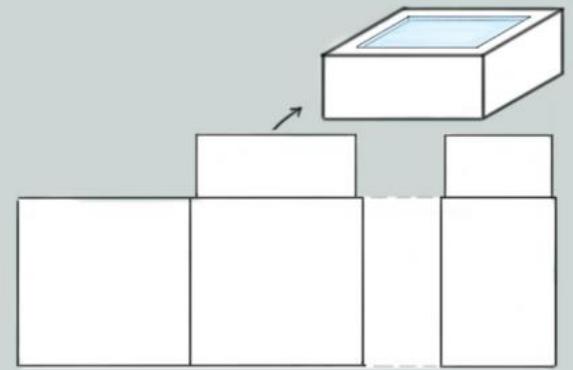
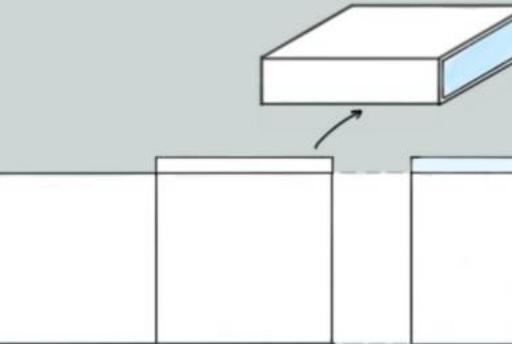
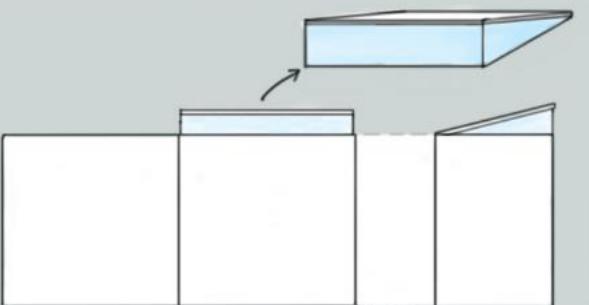
Floor Plans



Side Views

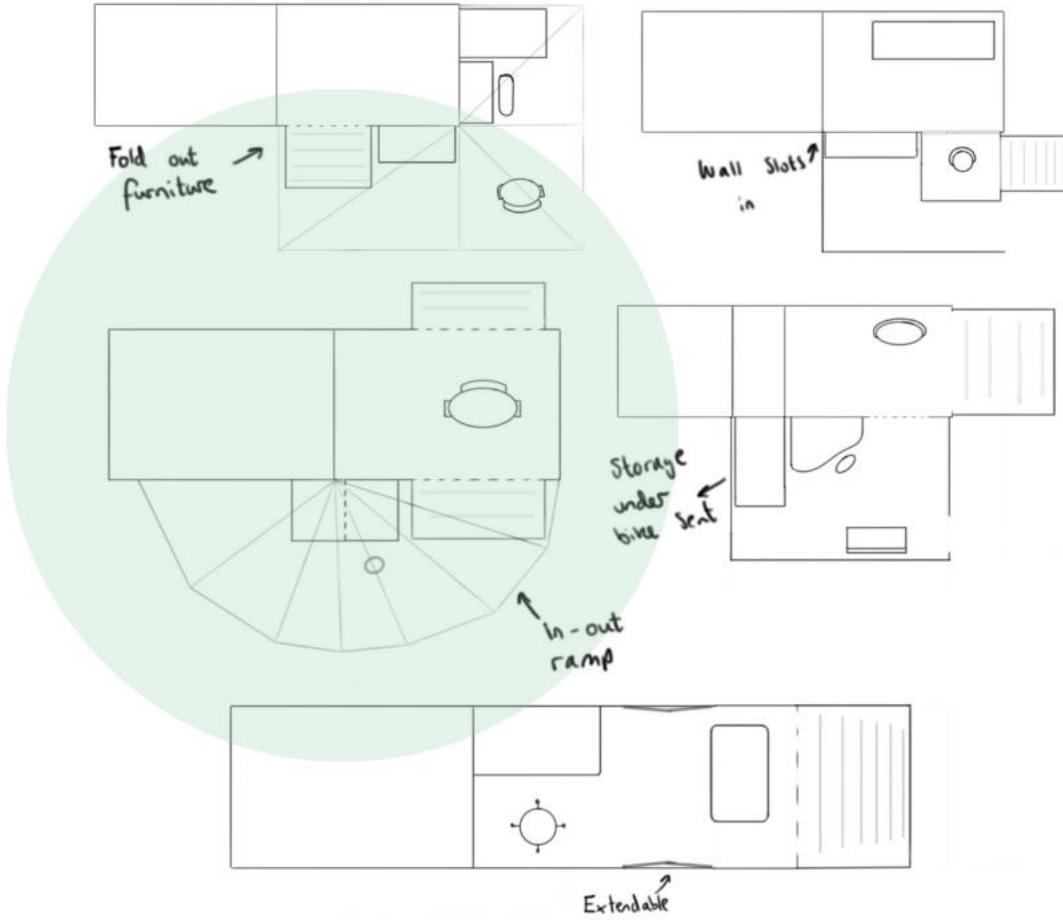


Roof Ideas

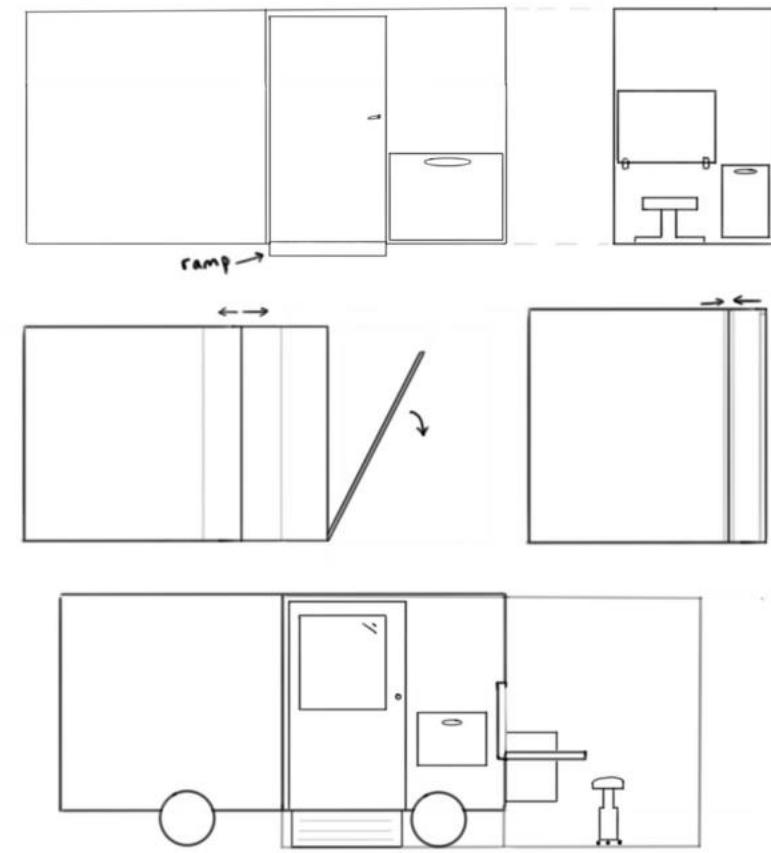


Interior Ideation

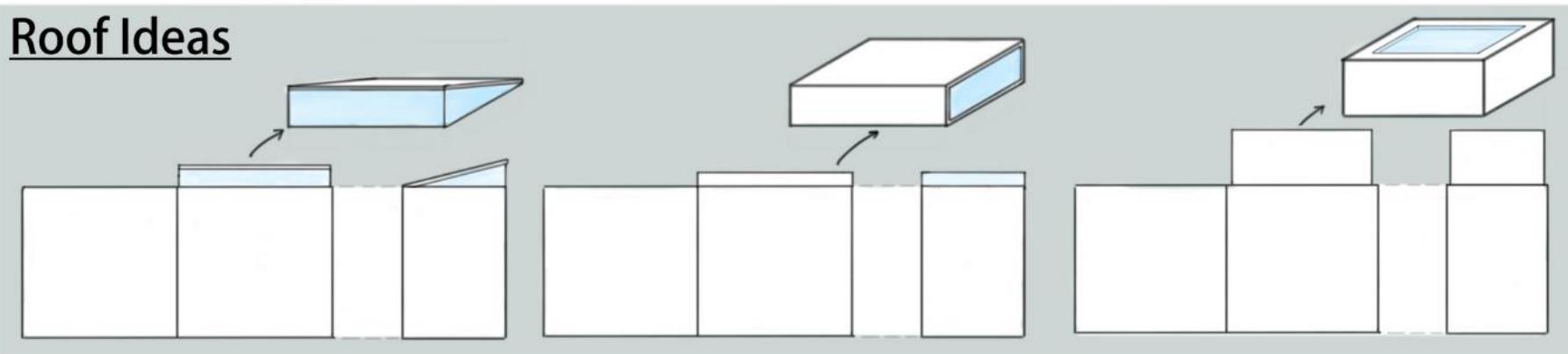
Floor Plans



Side Views



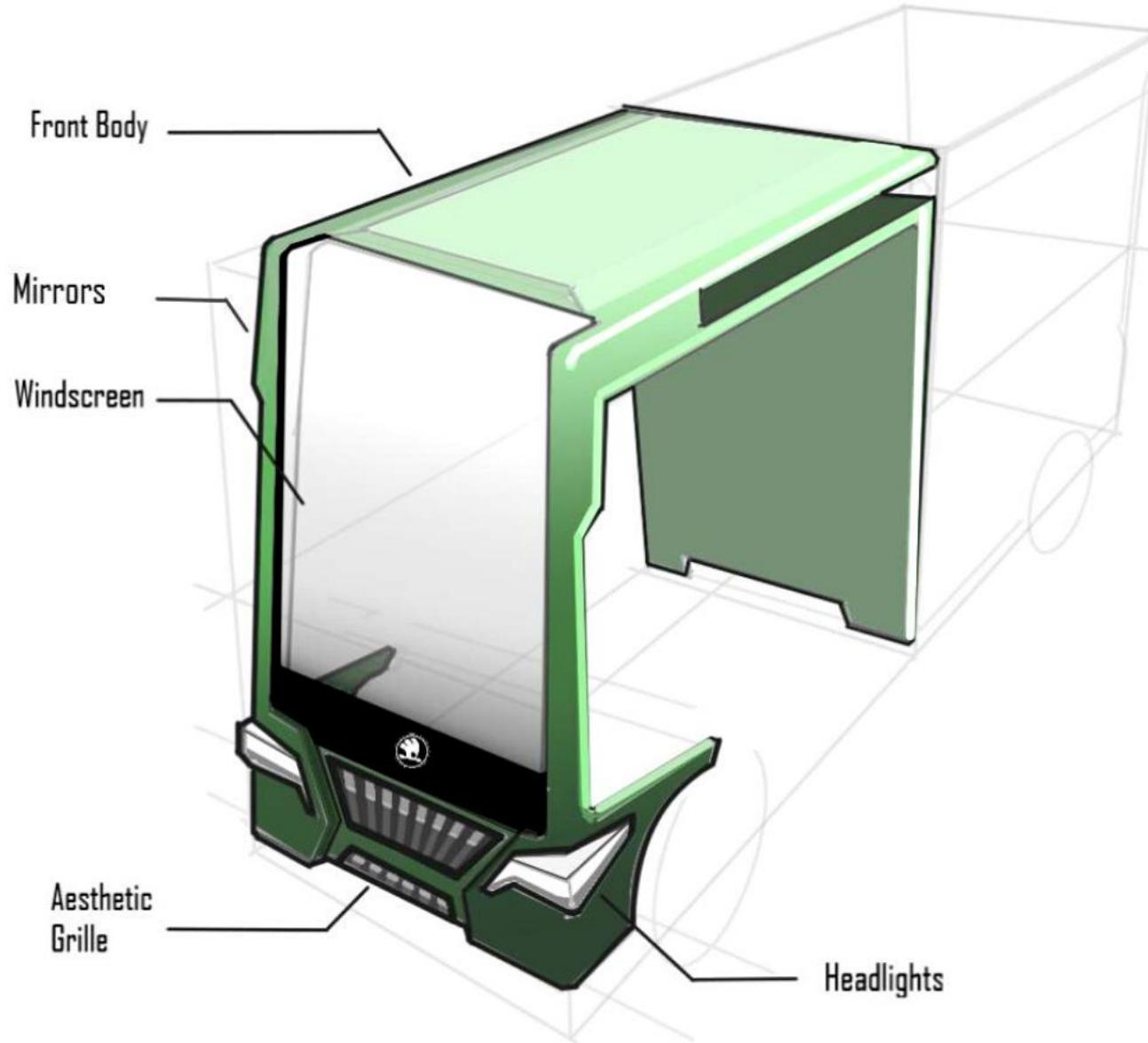
Roof Ideas



CONCEPT REFINEMENT



Front Exterior Body Refinement



Refinements

Refine Front Body for:

Chassis	Canopy
Interior Space	Windscreen
Furniture	Mirrors
Headlights	Electricals
Grille	

Refine Windscreens & Mirrors

Aesthetic
Sunlight
Safety

Refine Grille for Aesthetics

Refine Headlights for Aesthetics

All need to be Manufacturable

Awning Refinement

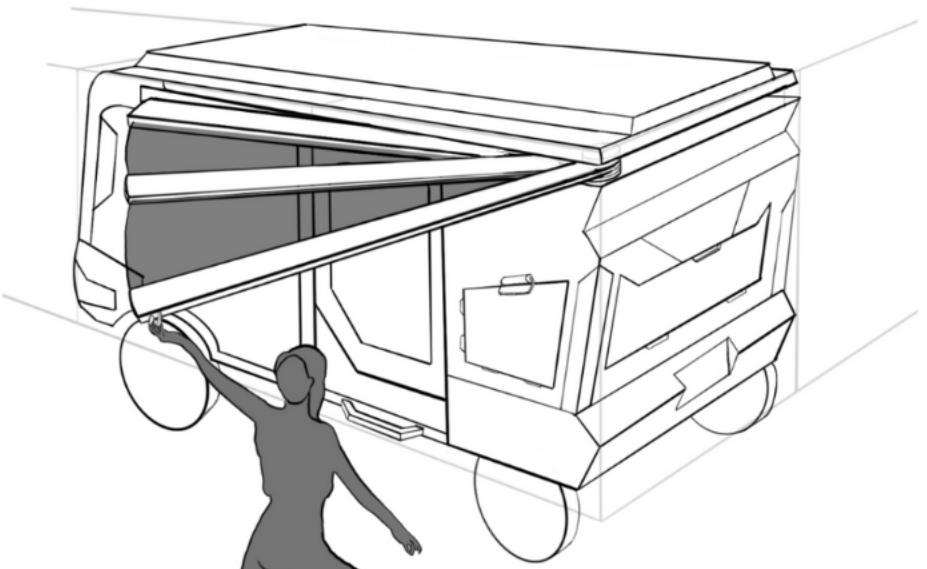


Material:

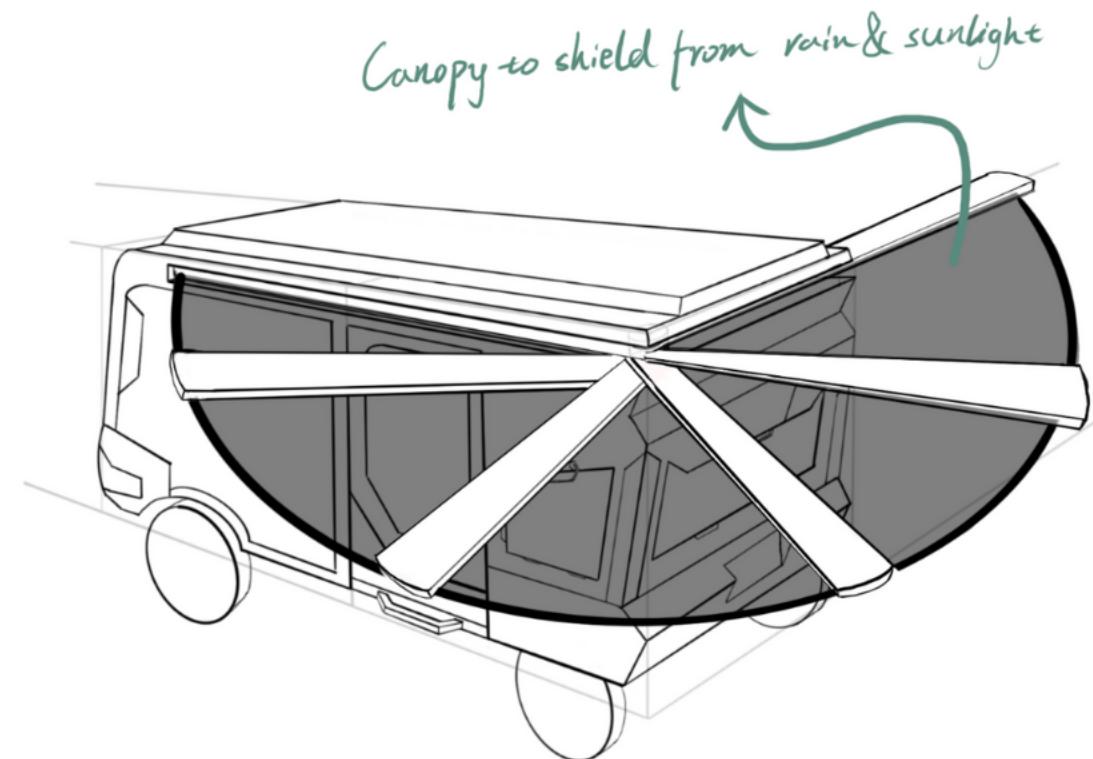
Fabric -- Oxford Cloth; Ribs -- Aluminium

Process:

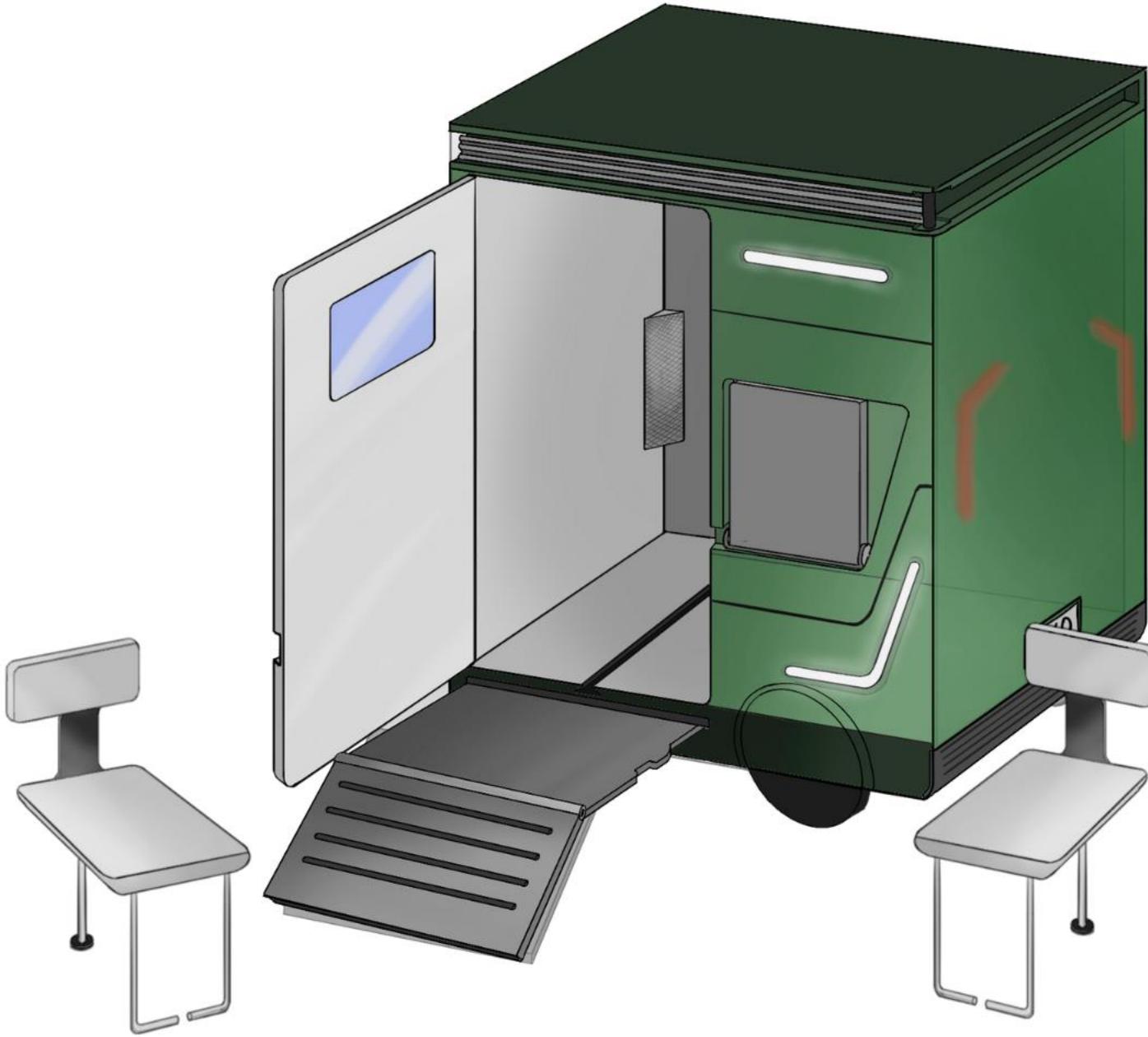
- ① Grab the pull ring at one end of the rib
- ② Pull towards the back of the testbox
- ③ Clamp the rib over the slot in the rear



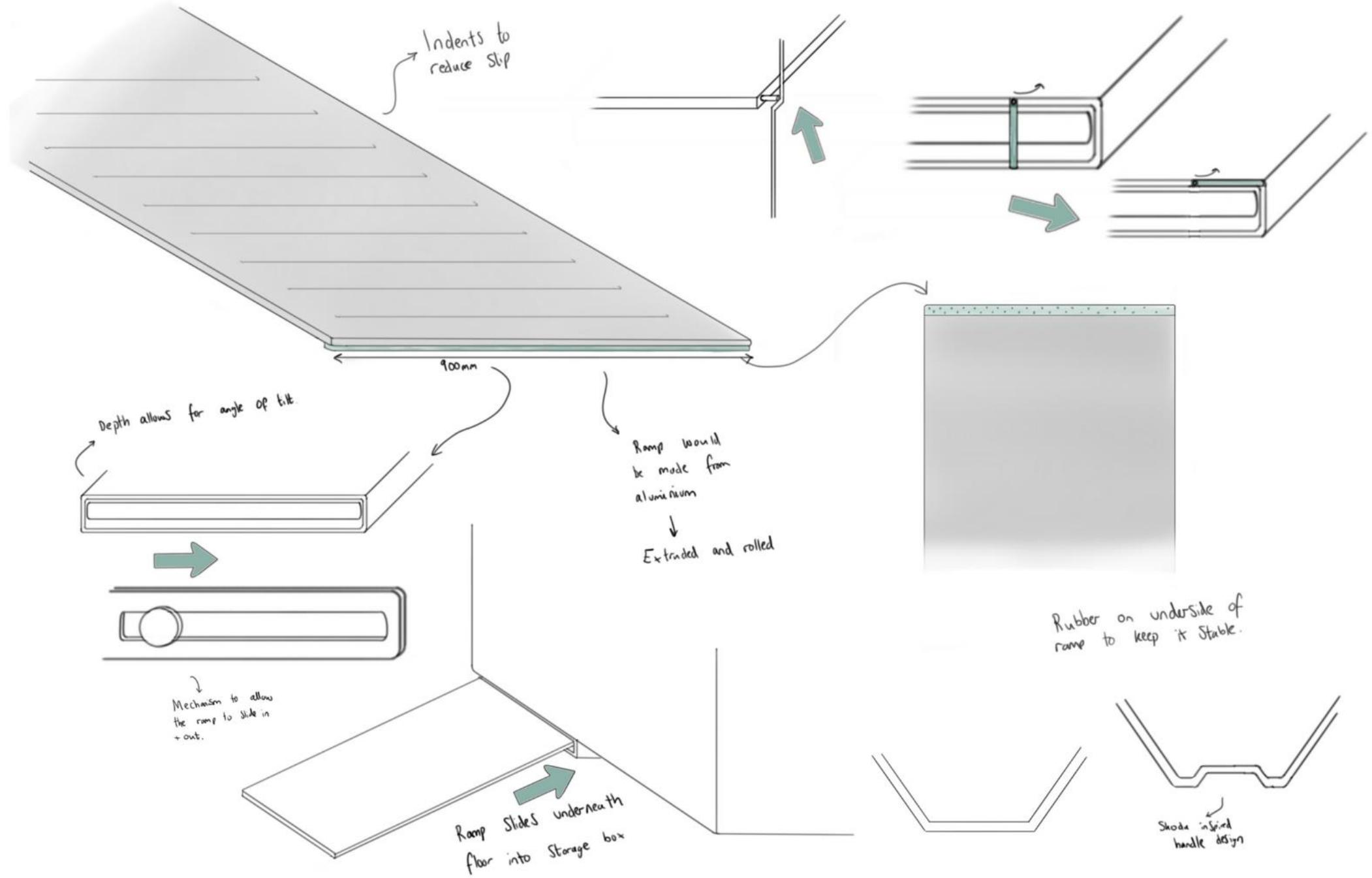
Overhead grip reach of
5%th female : 1824.1 mm



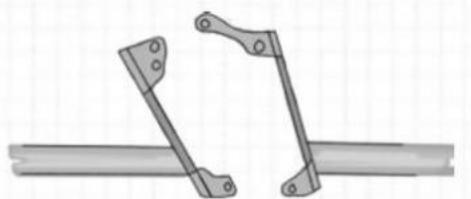
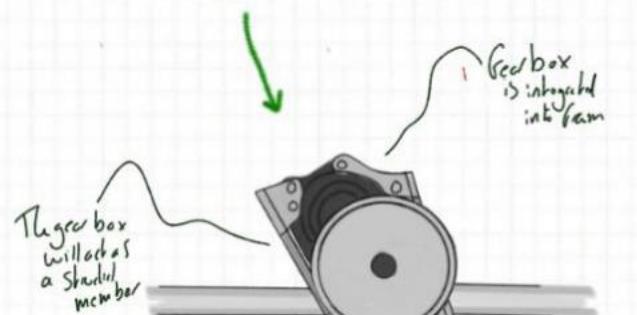
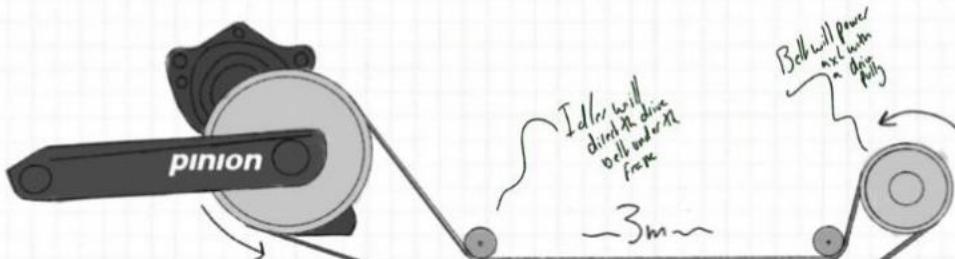
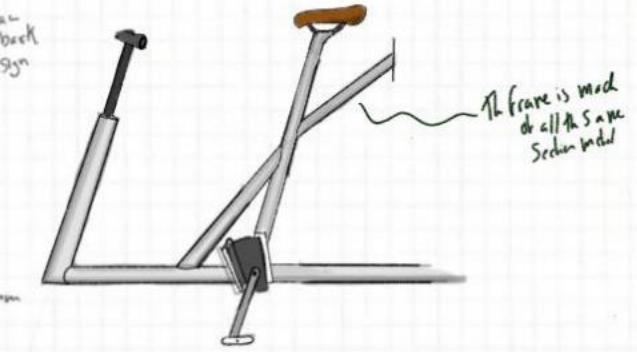
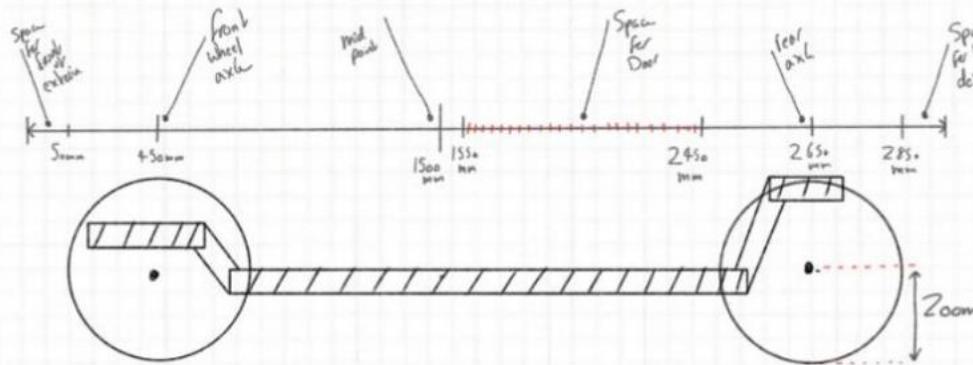
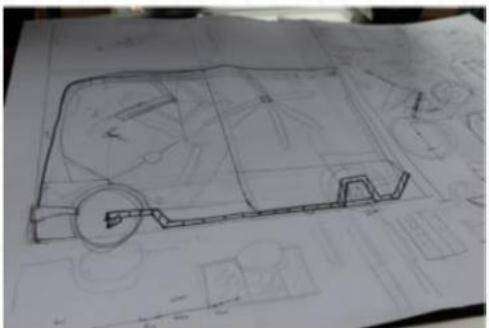
Layout Refinement



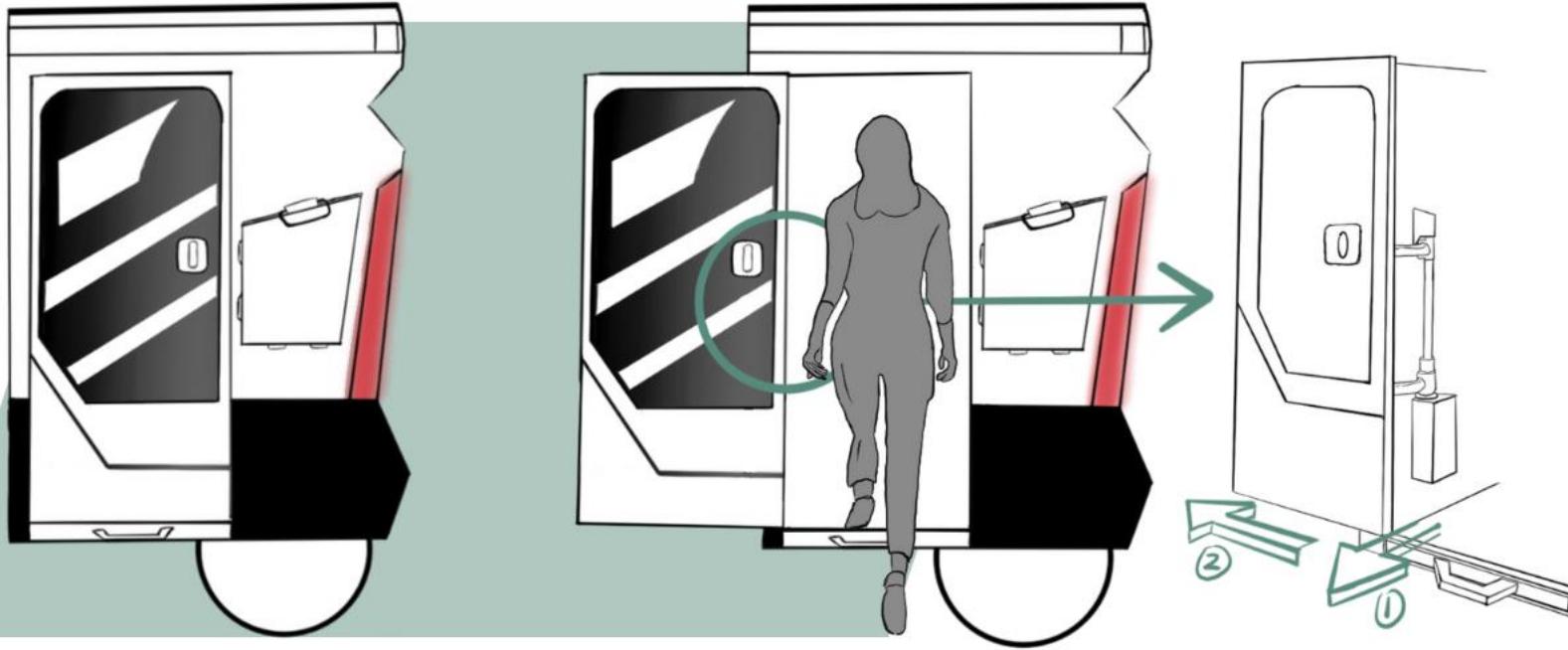
Ramp Refinement



Chassis Design Refinement

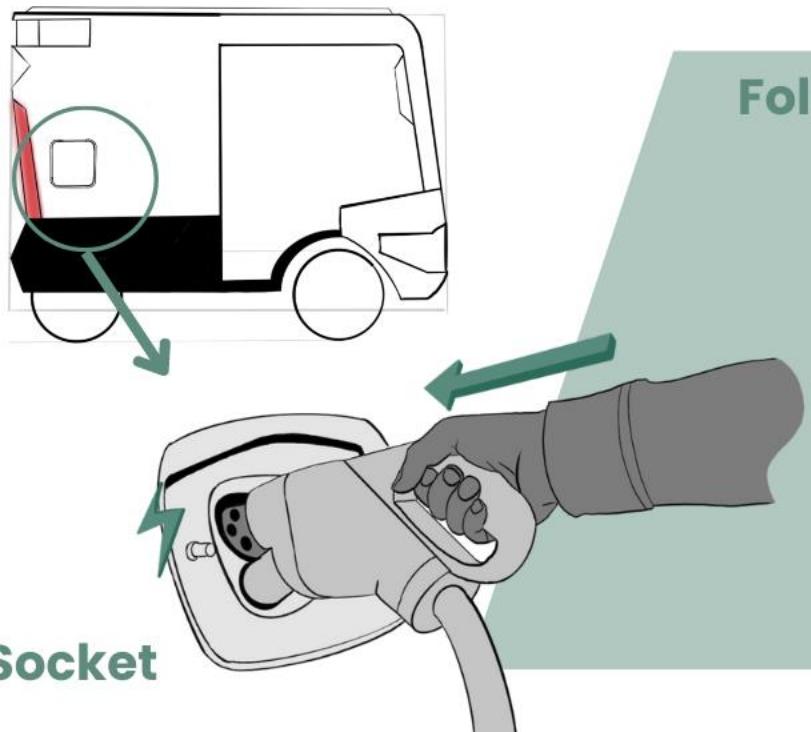


Ramp Refinement



Door

- ① Pull the door out
- ② Slide it sideways



Foldable Table

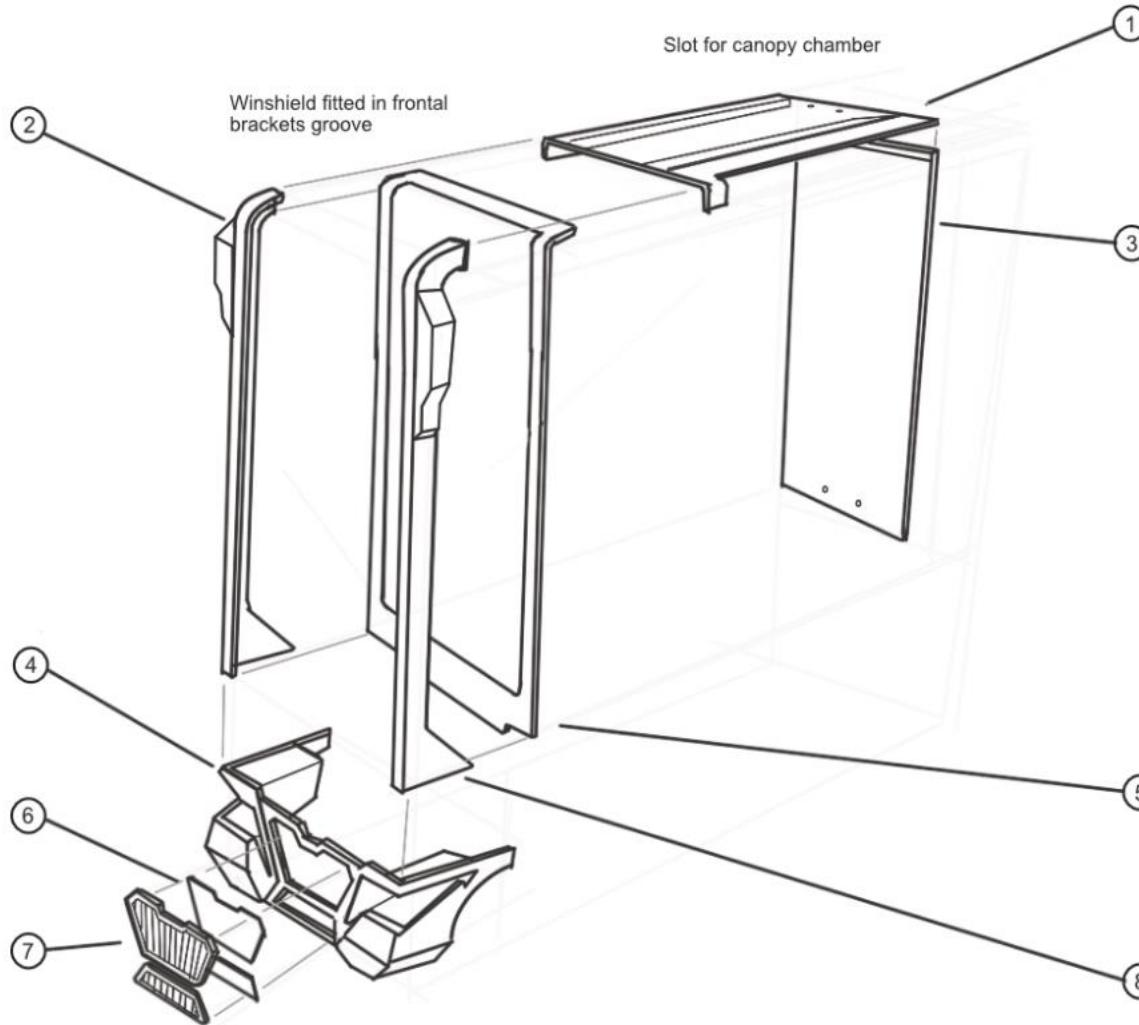


Ramp

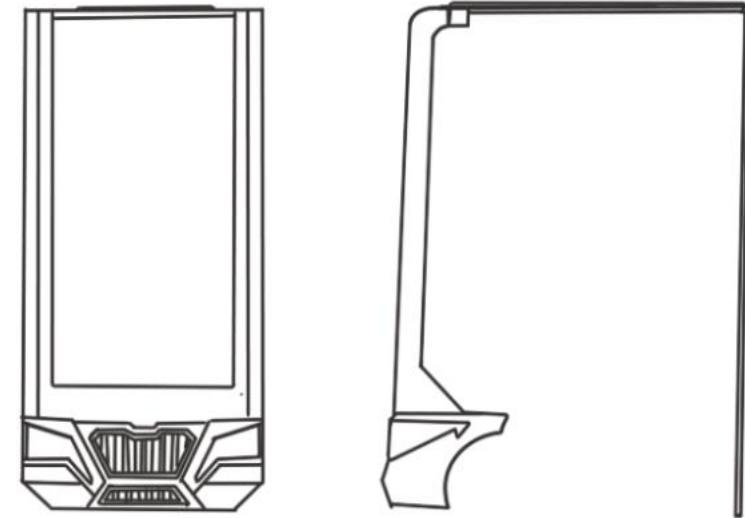
- ① Pull out the board under the door
- ② Put it down

TECHNICAL DISCOVERY

Front Exterior Body Discovery

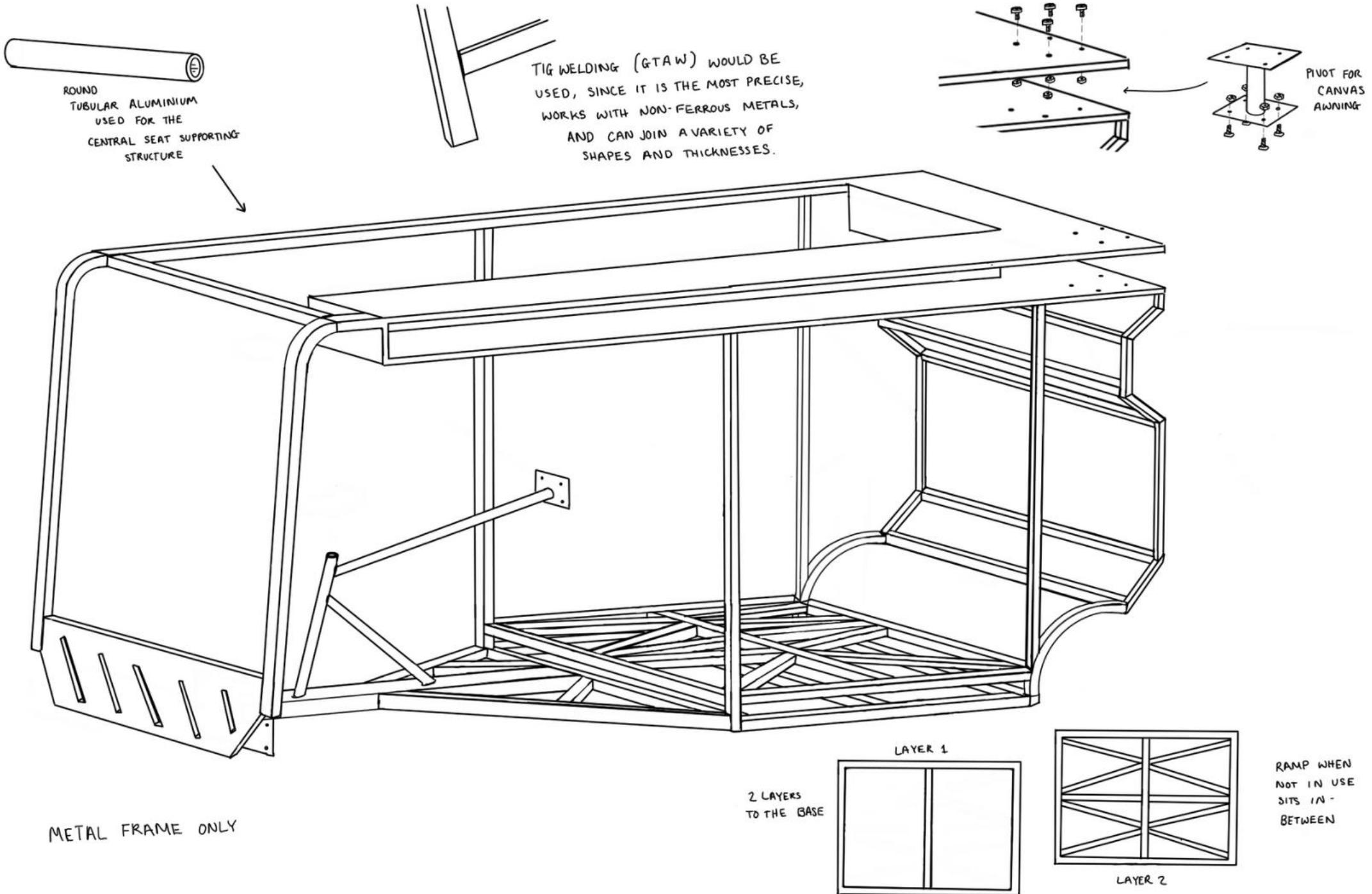


*All parts are joined through the use of adhesive as the main material is Carbon fibre instead of a metal like Aluminum which requires welding.

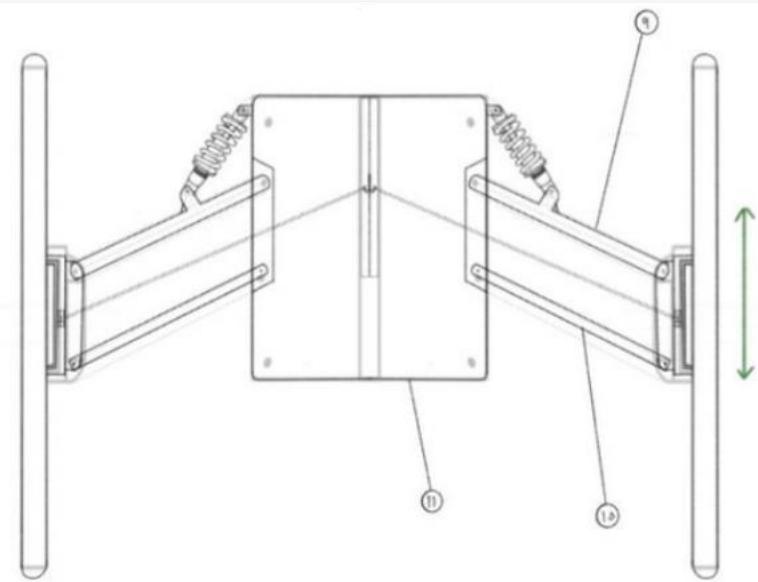
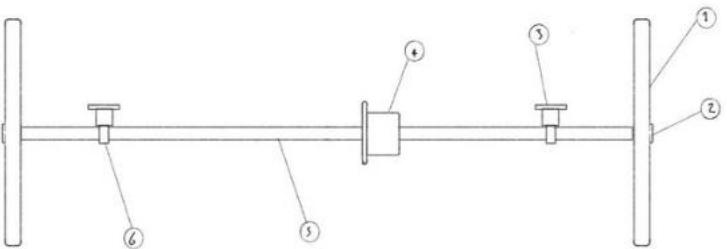
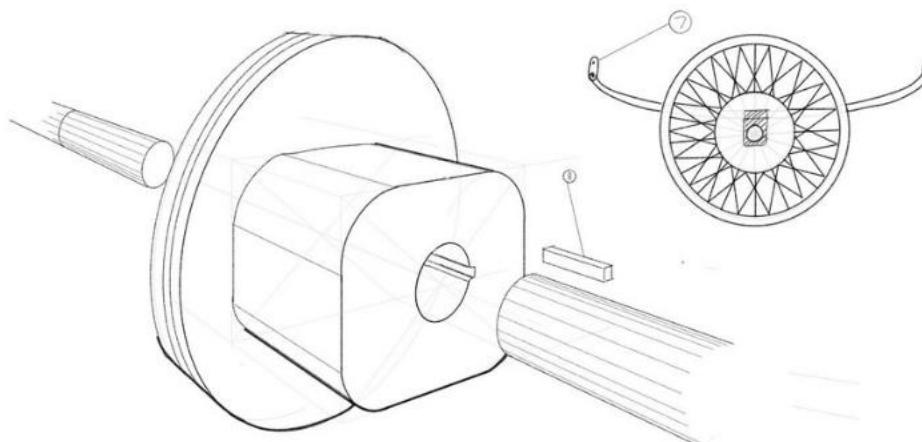
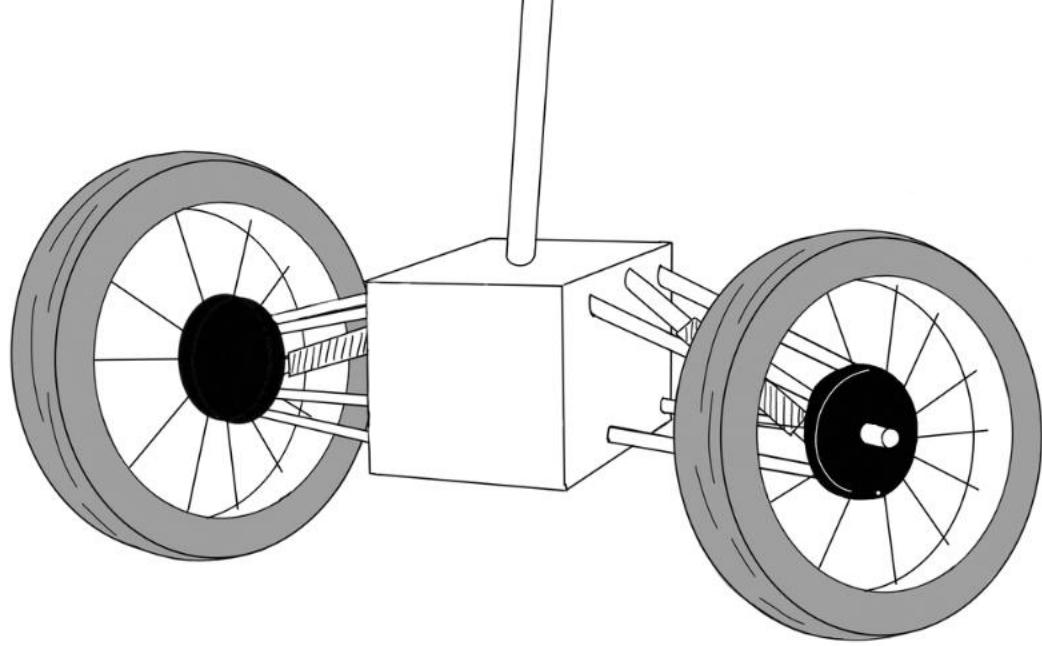
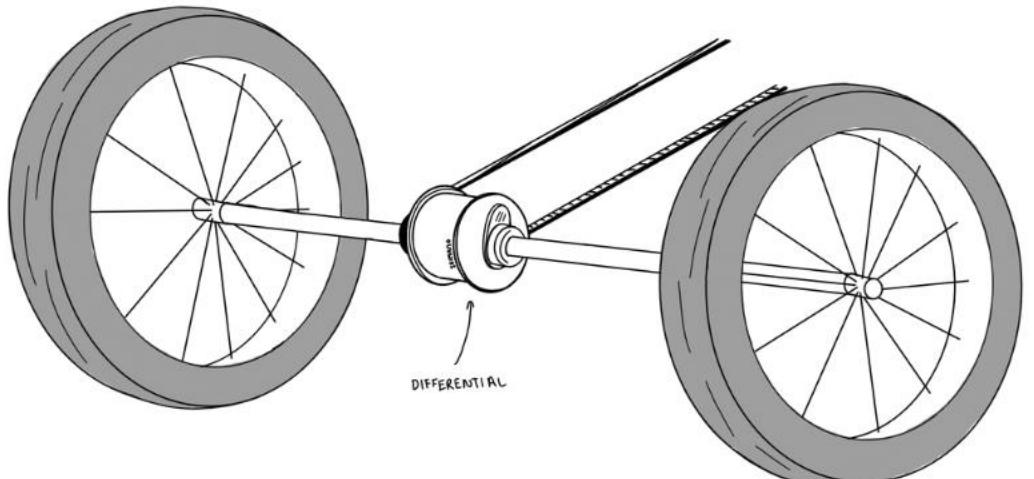


No.	Part	Material	Method	Quantity
1	Roof	Carbon Fibre	Layup-process	1
2	Right Frontal Bracket	Carbon Fibre	Layup-process	1
3	Rear Wall	Carbon Fibre	Layup-process	1
4	EAV Front	Carbon Fibre	Layup-process	1
5	Windshield	Laminated Glass	Glass Cutting	1
6	Grille Seal	ABS	Injection Moulding	1
7	Grille	ABS	Injection Moulding	1
8	Left Frontal Bracket	Carbon Fibre	Layup-process	1

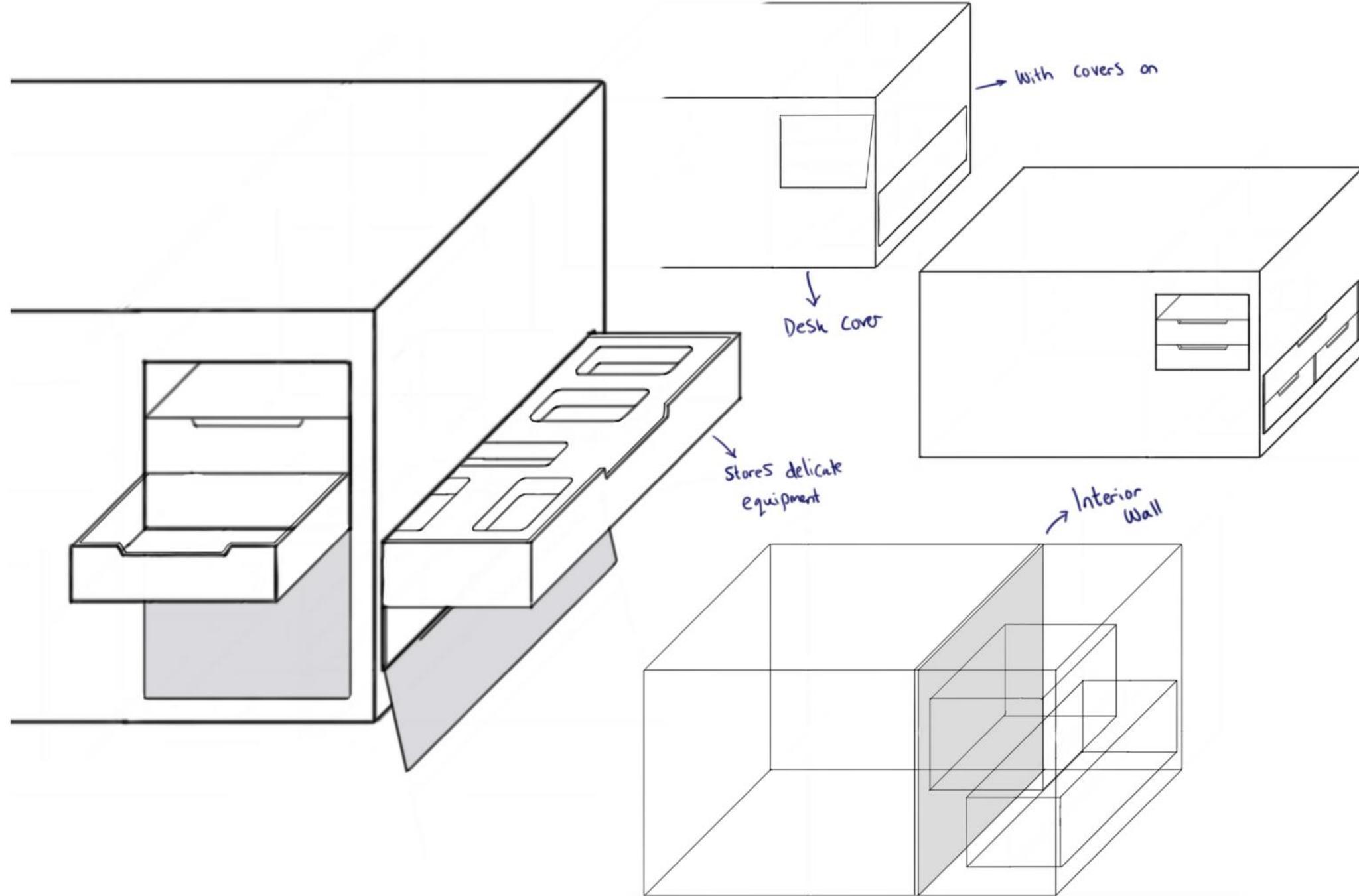
Chassis Frame Discovery

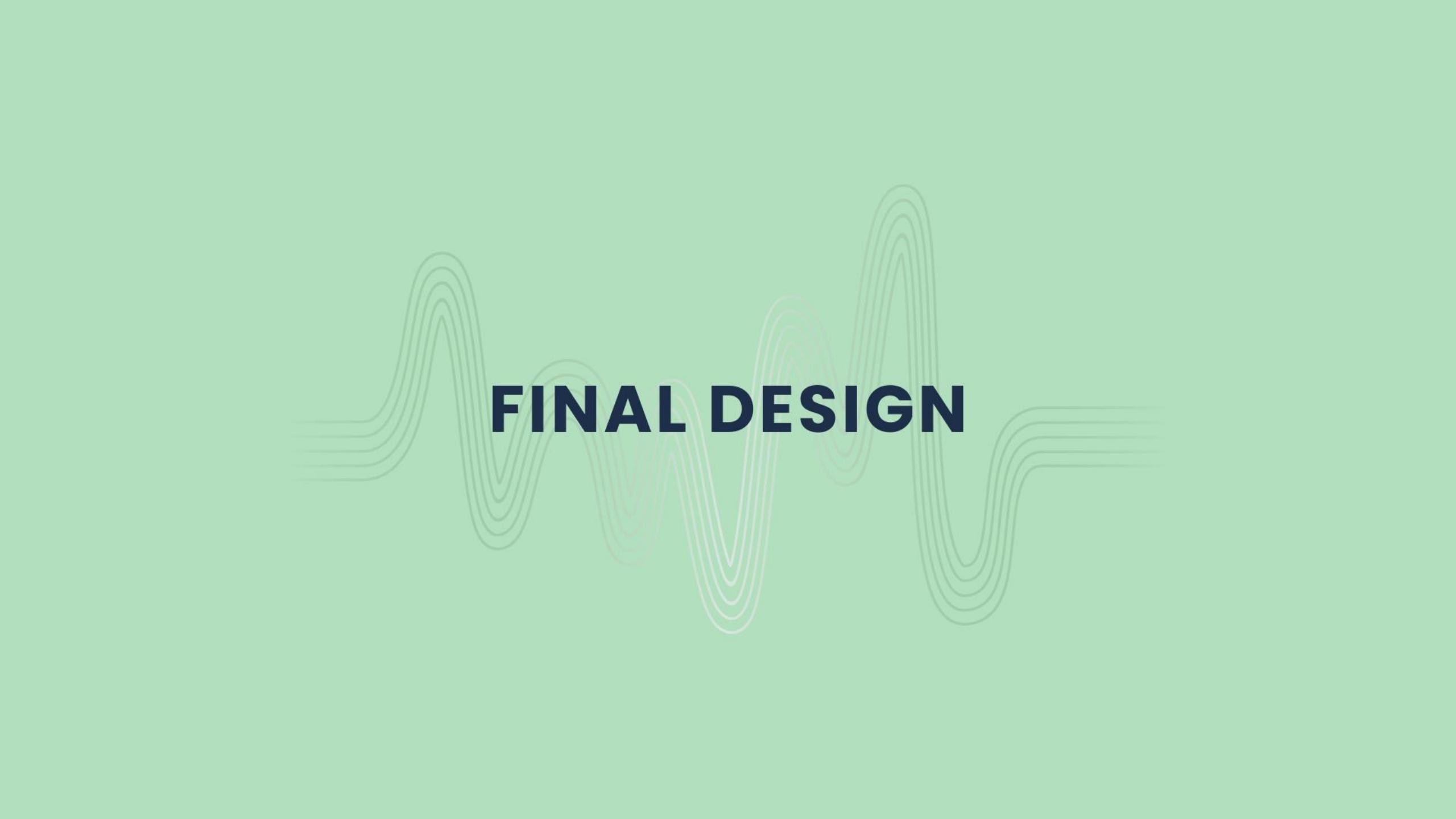


Chassis Axles Discovery



Compartments Discovery



The background features a subtle, abstract design composed of several thin, light gray wavy lines that create a sense of depth and motion across the entire frame.

FINAL DESIGN

SKODA AUDIA

THE FUTURE FOR MOBILE AUDIOLOGY



FAST



LIGHT

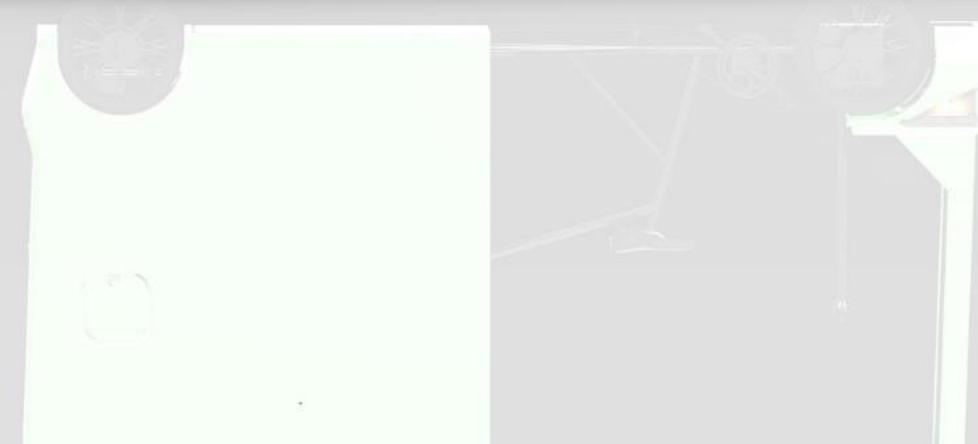
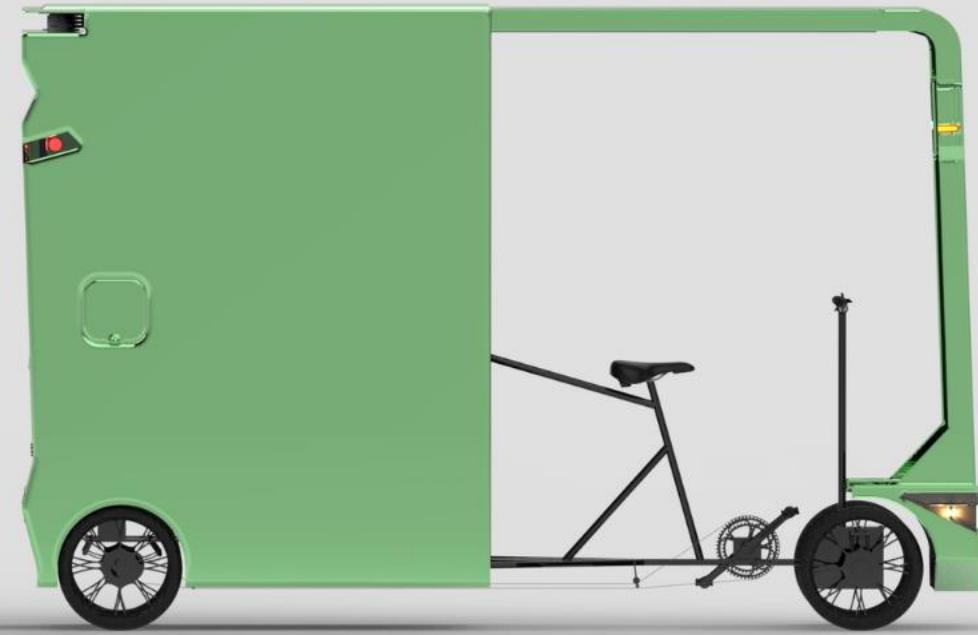
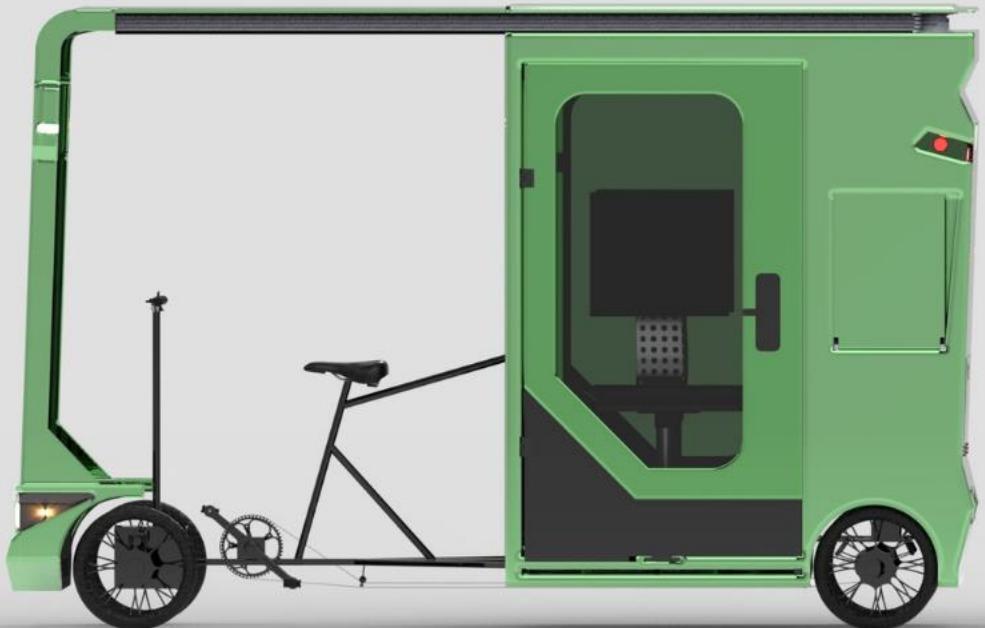


VERSATILE



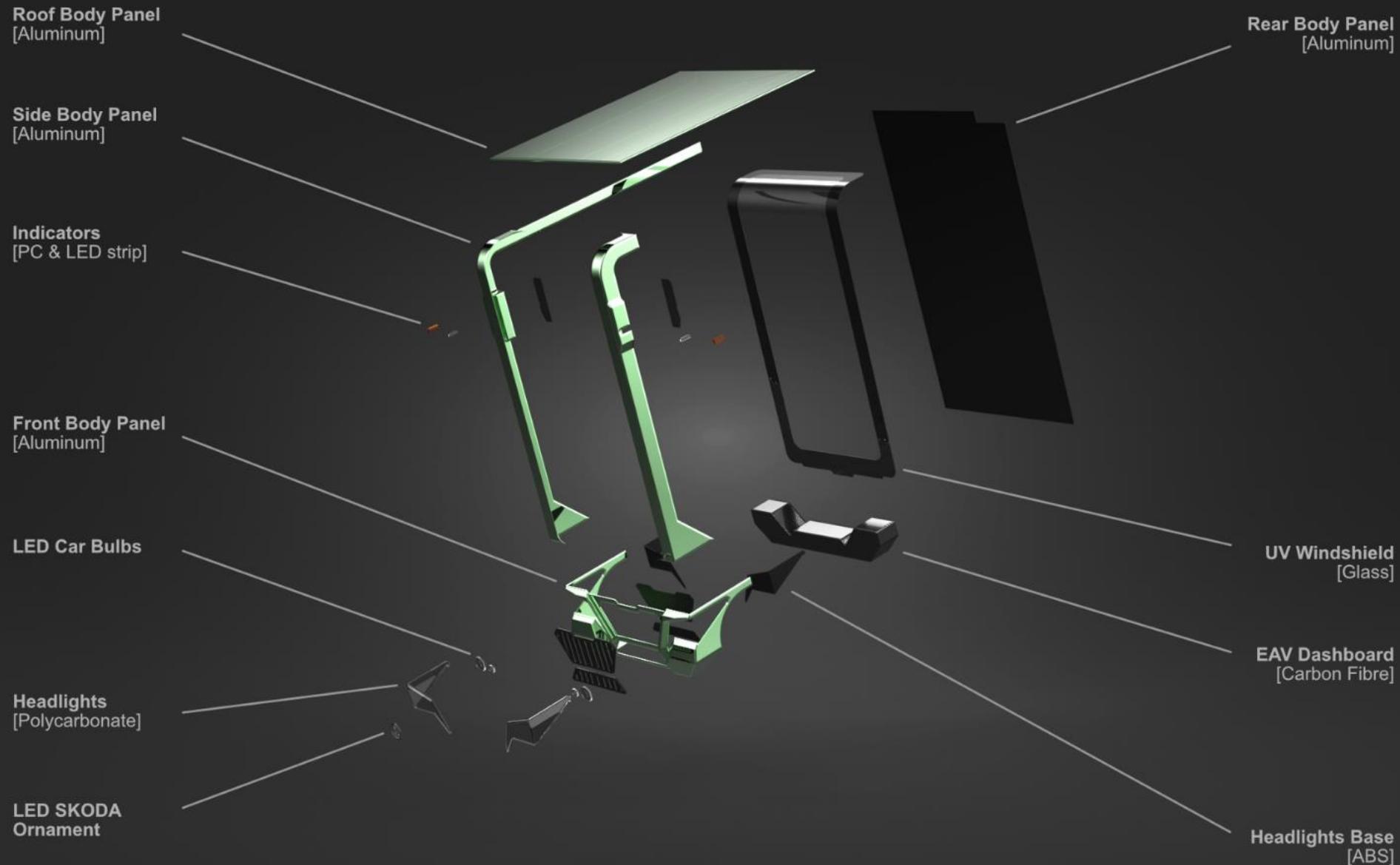




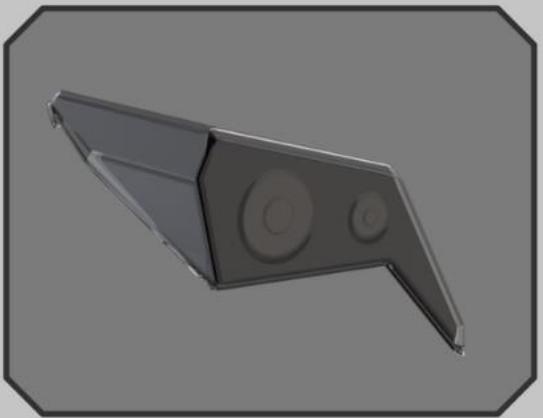








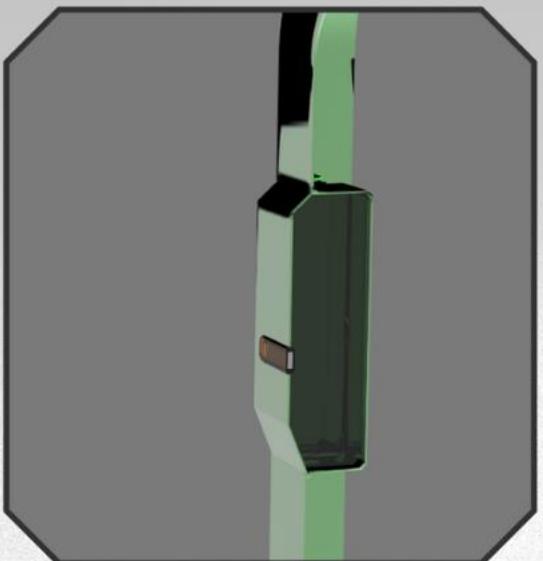
EXPLODED VIEW



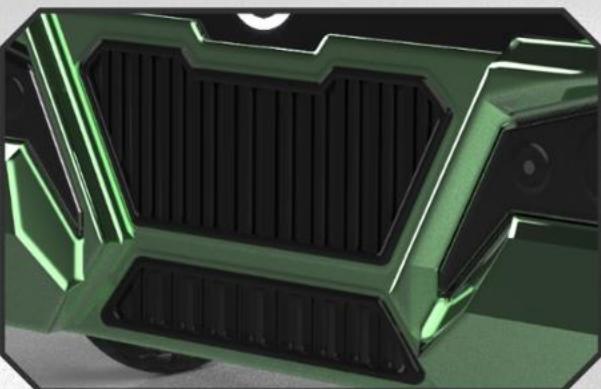
Modern Injection Moulded Headlight



Aesthetic LED SKODA Ornament



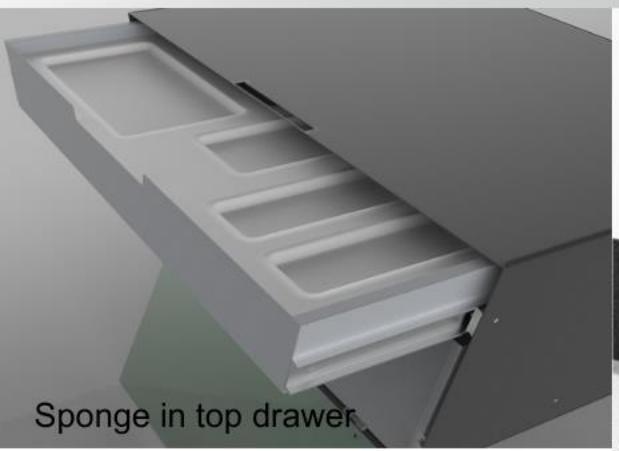
Ergonomic Mirror with LED Indicators



Aesthetic SKODA Grille



Back storage



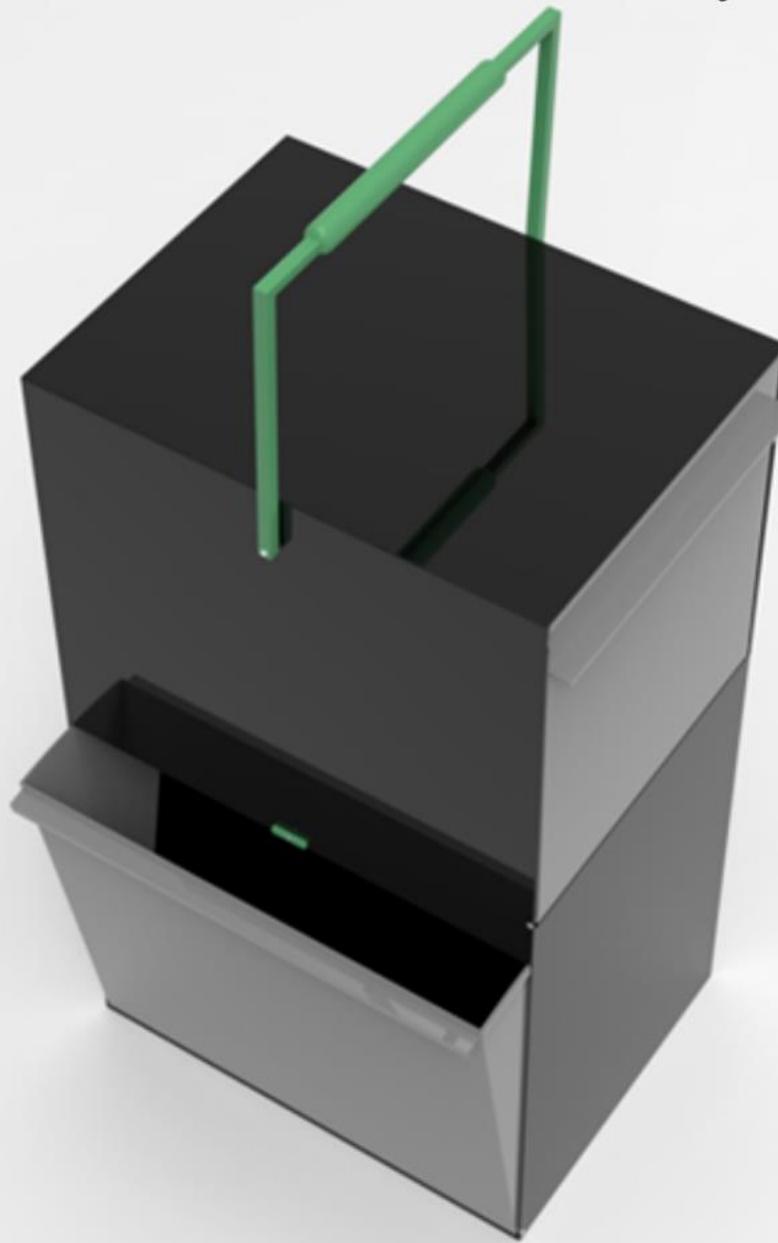
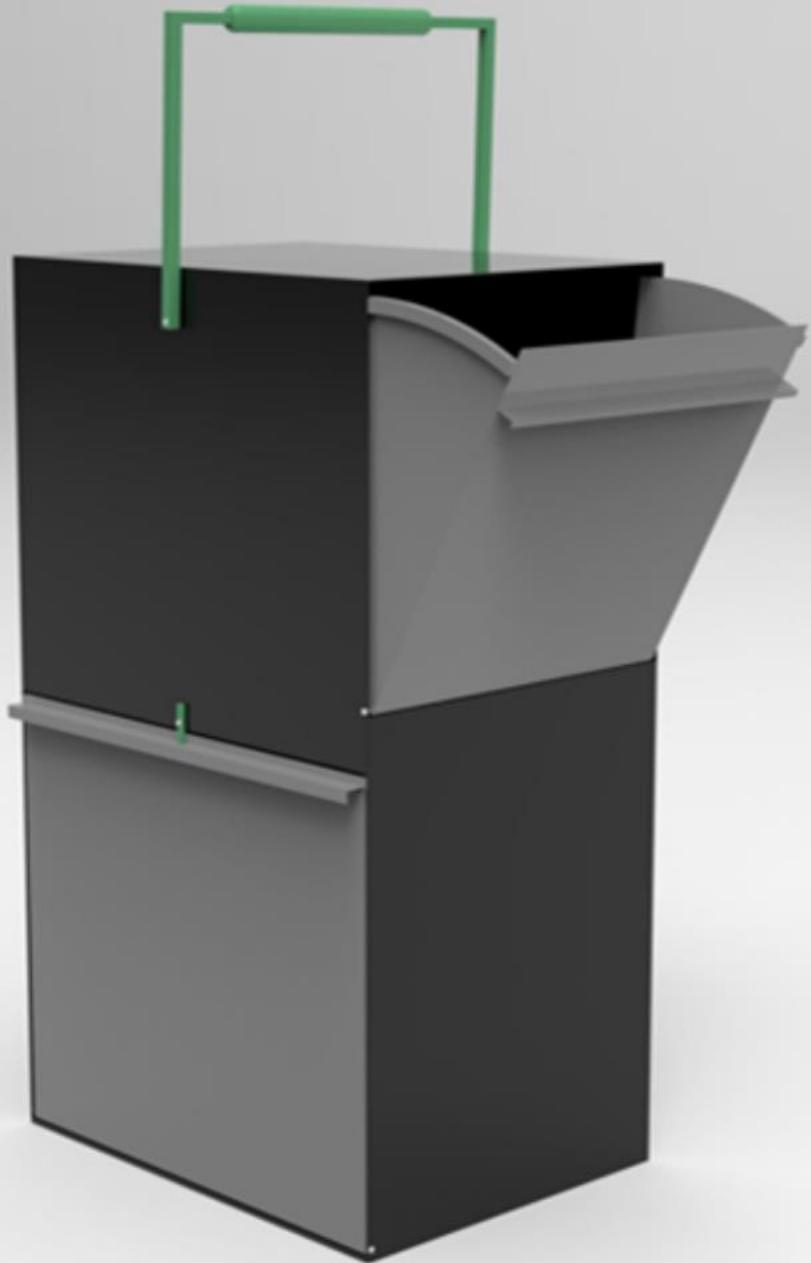
Sponge in top drawer

Laminated plywood drawers
Steel drawer runners



Side storage

Smaller areas - injection moulded PE
Main body - blow moulded HDPE



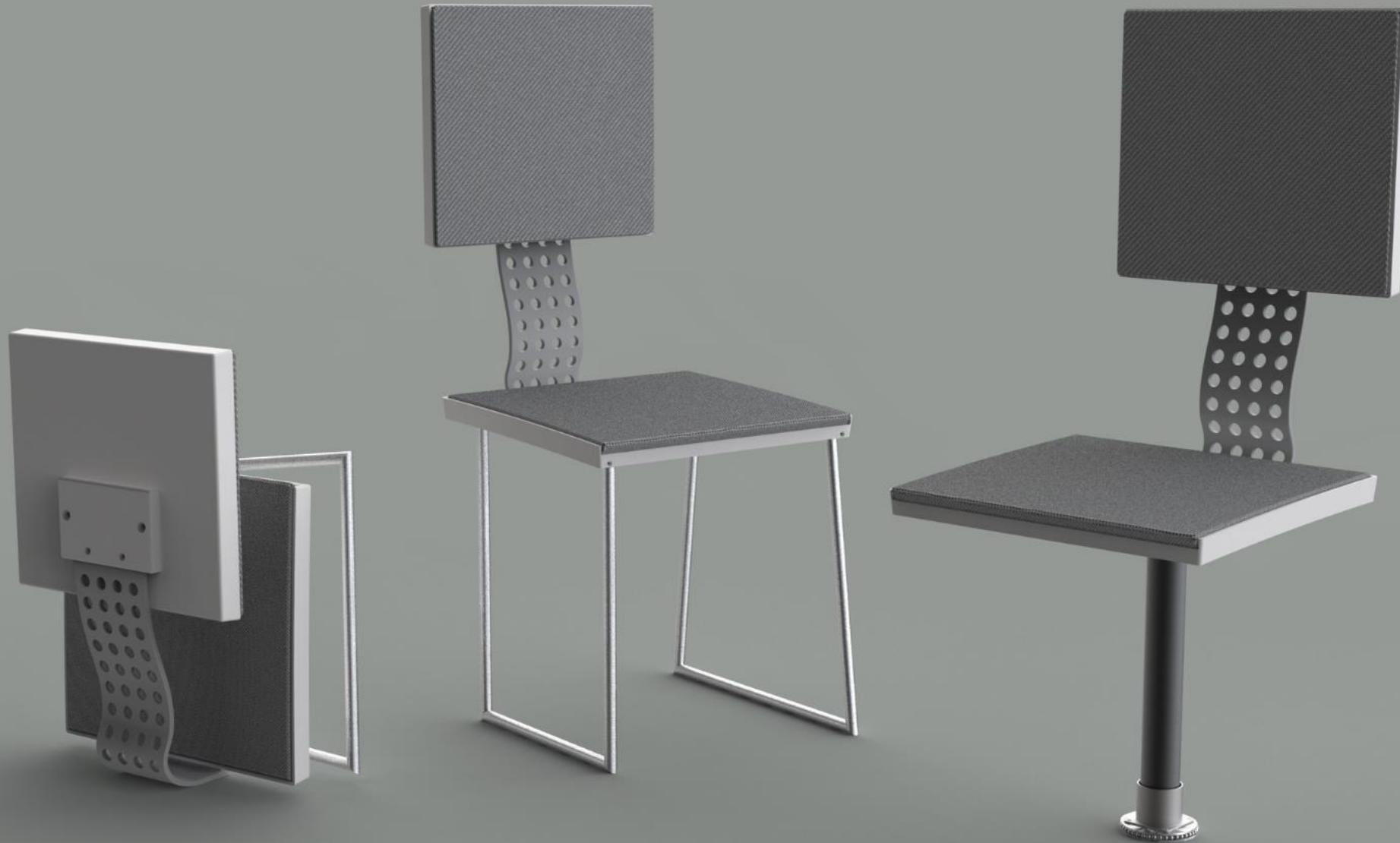
Waste and water disposal

The image displays three perspective views of a modern, minimalist folding chair. The chair features a dark grey, rectangular seat and backrest. It is supported by a white frame made of tig-welded aluminium tubes. The legs are designed to fold under the seat. In the middle view, the chair is shown partially folded, revealing its internal structure and a small hinge mechanism. The right view shows the chair completely folded, with its legs tucked neatly beneath the seat.

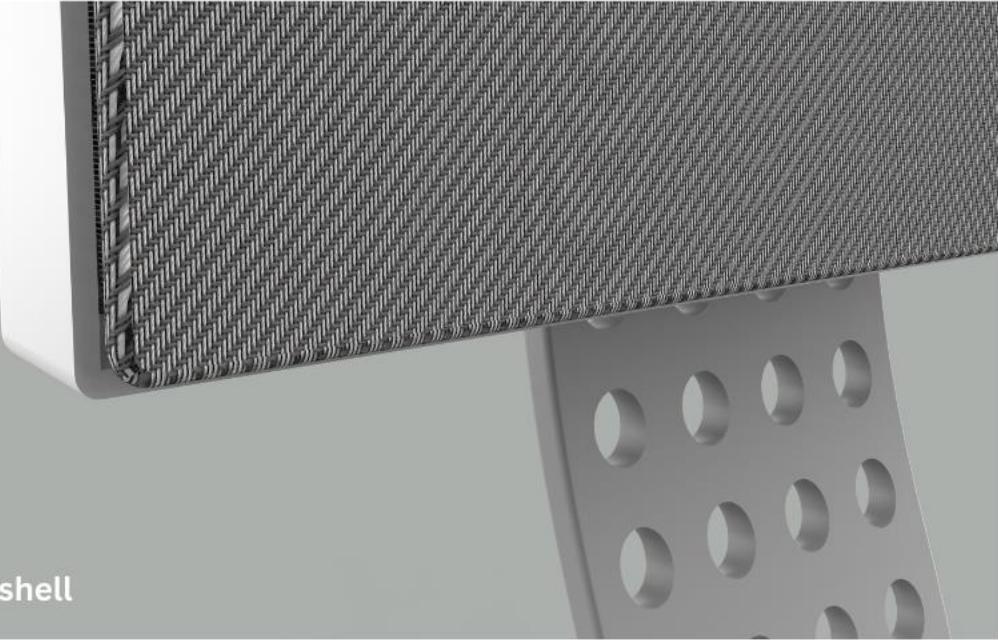
Tig welded aluminium tubes
Nylon coated sponge

Folding of waiting area chair for storage





Folding chair & sliding chair design



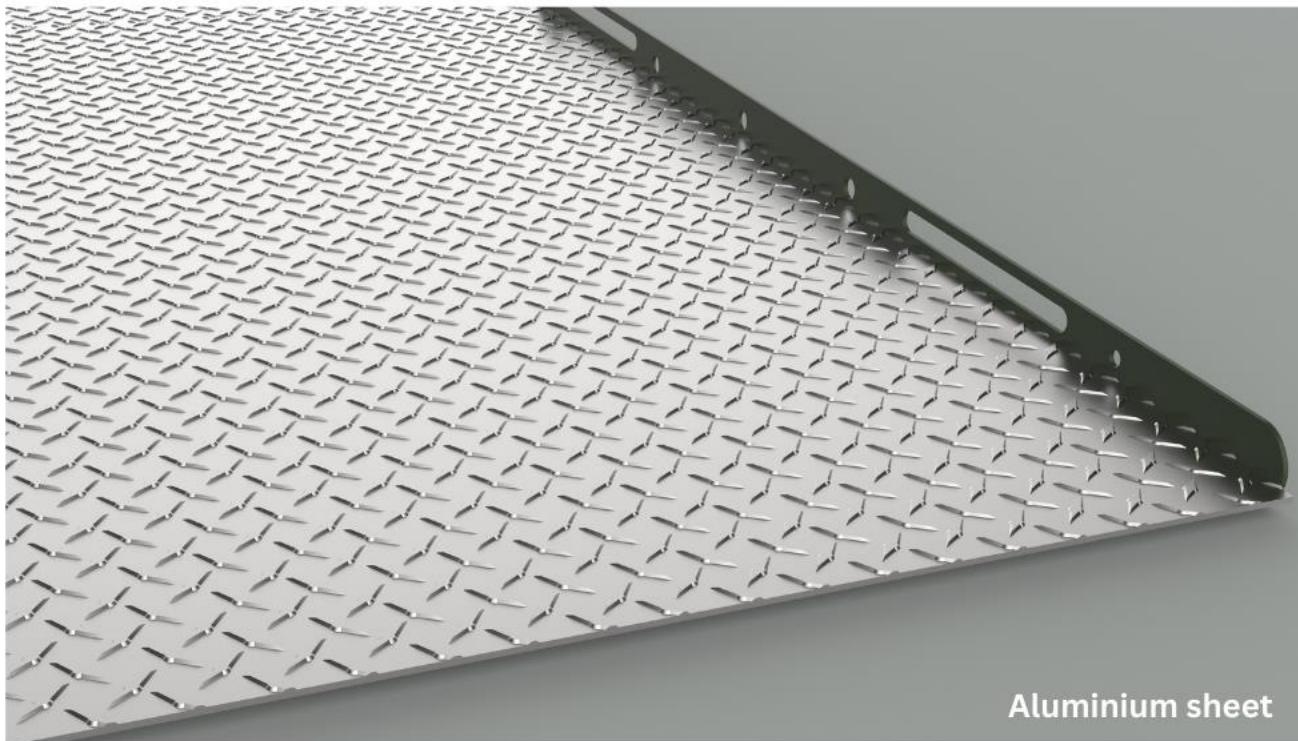
Plastic shell



Stainless steel base & rod



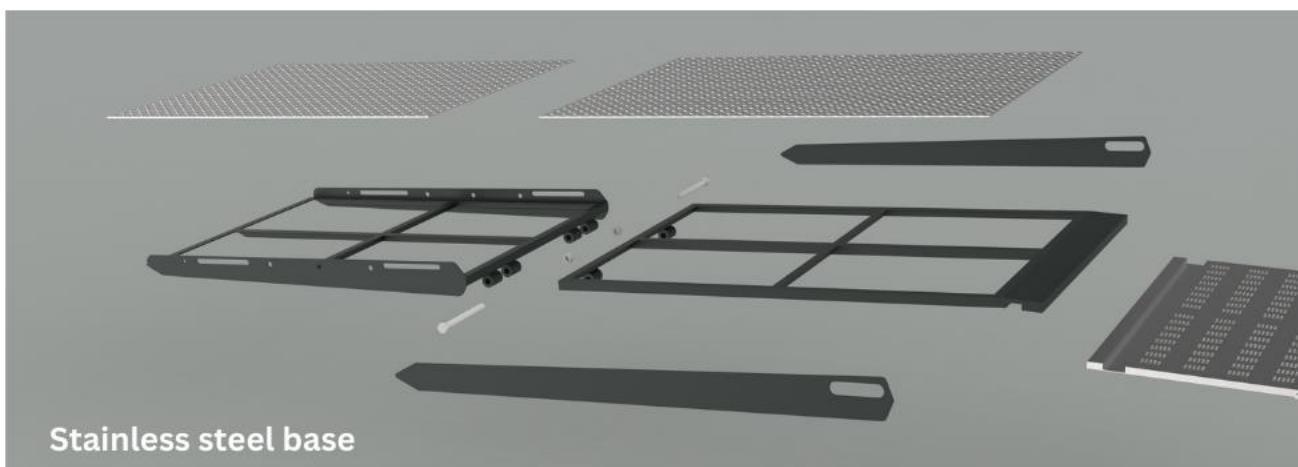
Patient chair details



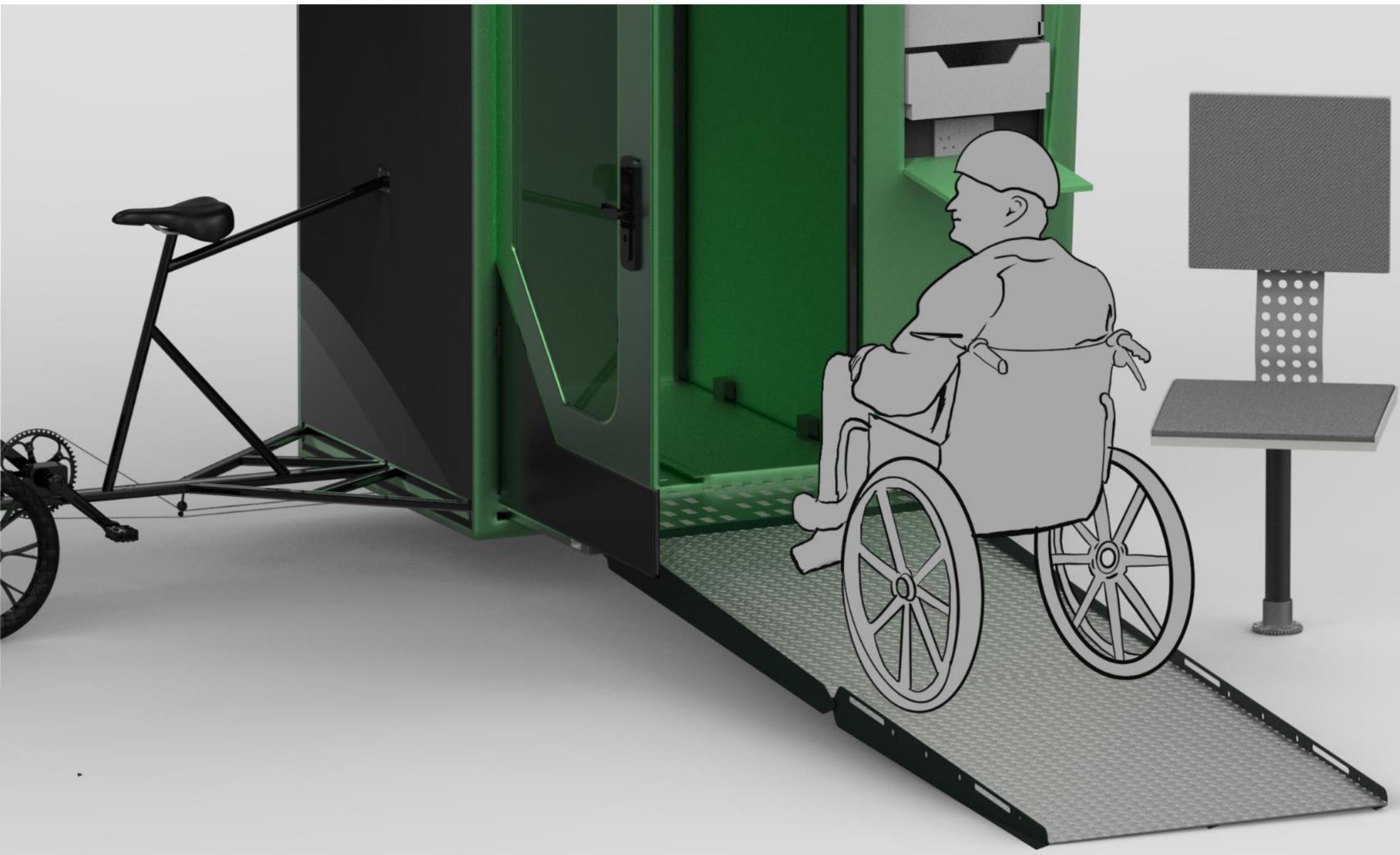
Wheelchair ramp pattern

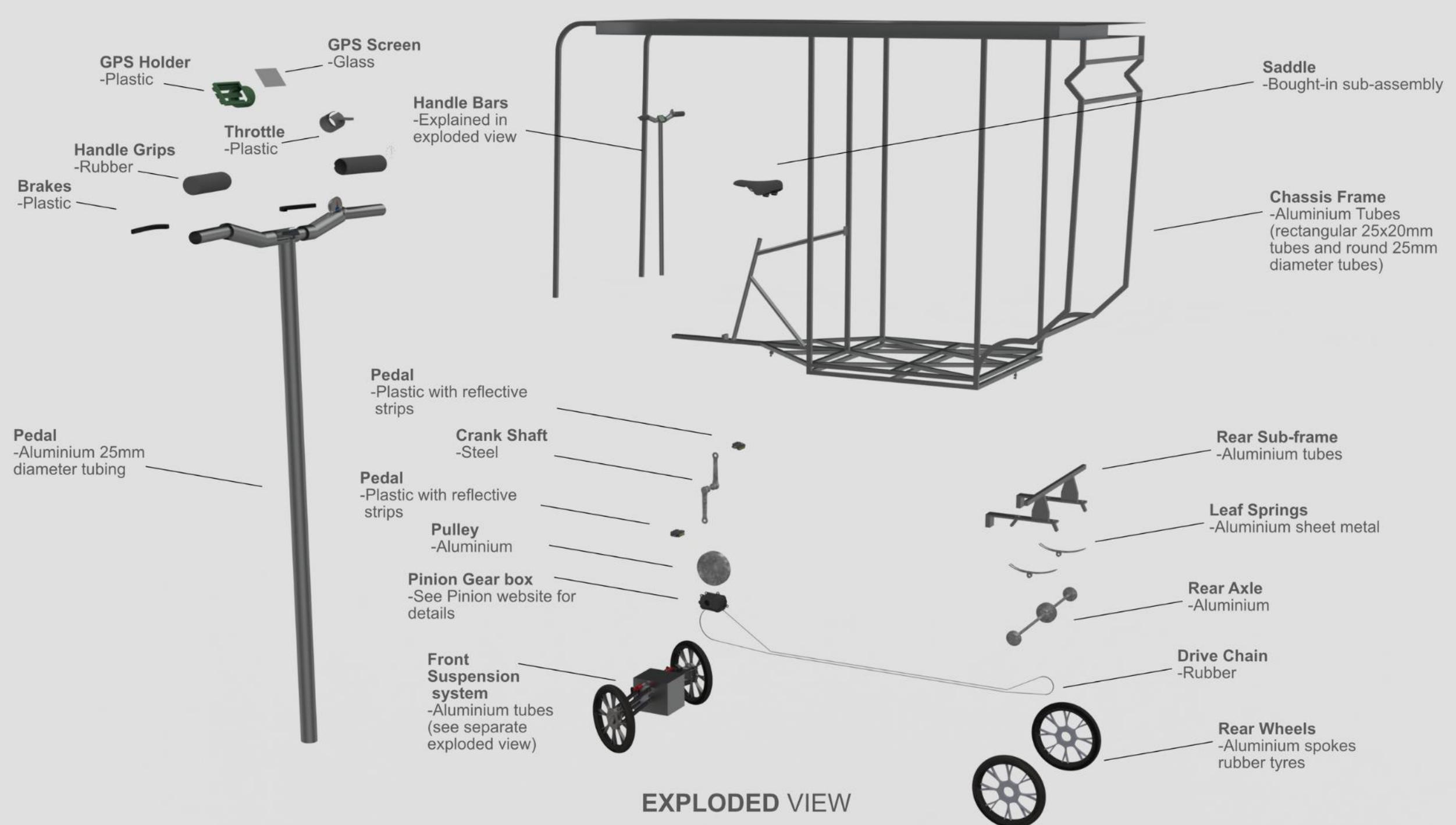


Wheelchair ramp



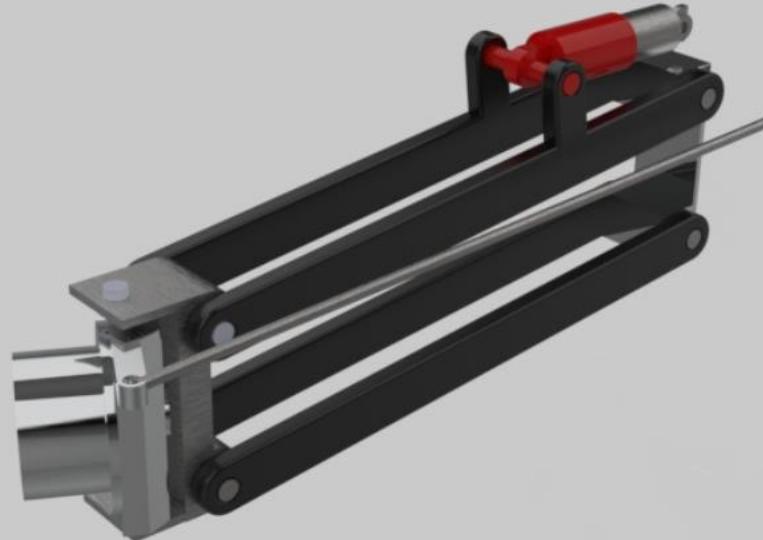
Stainless steel base







Pinion Gear box



Steering



THANK YOU

Now, Audia is off to help the world.



PERSONAS

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Oliver Wilson

<https://youprobablyneedahaircut.com/little-boy-haircuts/>

John Rivers

[https://www.istockphoto.com/search/2/image?
phrase=walking+stick](https://www.istockphoto.com/search/2/image?phrase=walking+stick)

Emily Blight

Department for Transport. (2021) *Transport: Disability and Accessibility Statistics 2020*. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019477/transport-disability-and-accessibility-statistics-england-2020.pdf

Laurence, E. (2023) *Stay-At-Home Moms And Depression: What To Know And How To Get Help*. [Online]. Available at: [https://www.forbes.com/health/family/stay-at-home-moms-depression/#:~:text=The%20poll%20results%20also%20show,34%25of%20working%20moms\).](https://www.forbes.com/health/family/stay-at-home-moms-depression/#:~:text=The%20poll%20results%20also%20show,34%25of%20working%20moms).)

shironosov. (2018) Office Manager Stock Photo. Place of publication: Laurence, E. (2023) *Stay-At-Home Moms And Depression: What To Know And How To Get Help*. [Online]. Available at: [https://www.forbes.com/health/family/stay-at-home-moms-depression/#:~:text=The%20poll%20results%20also%20show,34%25of%20working%20moms\).](https://www.forbes.com/health/family/stay-at-home-moms-depression/#:~:text=The%20poll%20results%20also%20show,34%25of%20working%20moms).)

Sarah Deluna

Michael Mims (2018) Middle-aged Woman 12 May. Available at: <https://unsplash.com/photos/fWWiaDox0BU>

Alex Senior

Dr. Peter Neff (2020) [image] Available at: https://media.licdn.com/dms/image/C5622AQEnU99qaoFpEw/feedshare-shrink_800/0/1555609297985?e=2147483647&v=beta&t=gF5Gx4IDSvY0Frnf0cTKg4MkXOVz2z69EsVWnA5vm7xA [Accessed: 08/03/2023]

QUAD CYCLE TECHNOLOGY

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- Wheel Motor image** (online) 2018: <https://electrek.co/2018/06/07/electric-bicycle-hub-motors-vs-mid-drive/>
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