Benjamin POCOCK

CANDIDATE NUMBER: **3138**

CENTRE NUMBER: **62451**

Anything with this border will be feedback from end users and stakeholders

Anything with this border will be any messages or contact I have had with my primary users

Anything with this border will be photos /videos I have taken myself

Highlighting removed when converted to PDF. See the PowerPoint for the highlighting.

The videos also do not work, they are attached in the same folder with page number labelled.

This is where I will put my summary of the page and what I will do on the next page.

Summary and next steps:

Mark sheet

A LEVEL

DESIGN AND TECHNOLOGY

OCR Oxford Cambridge and RSA

In order to help your teacher and OCR to assess your work, it is really important that they know exactly where to find evidence in your portfolio to support decisions that they need to make regarding your marks.

To support them with this, please complete the table below, entering an '**X**' to indicate slide/page numbers where evidence is located that supports each area of assessment. Your teacher will help you to understand the different areas of the Marking Criteria.

You must have a video of your final prototype(s) within your portfolio. This should be evidence against Criteria 4.2.

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Investigation of the context

Design context

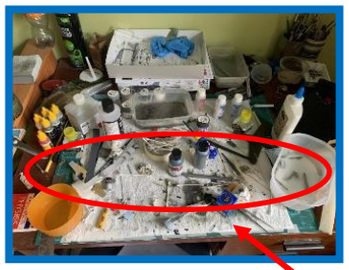
I am looking to design a product which can be used to store equipment and tools used in hobbies, This allows a larger workspace to be created. There are many (100s) of different hobbies which require large workspaces and different ways to store the equipment. It would be difficult to design 1 product to suit them all. But I am looking to make a product that could have a wide appeal and that can fulfil as many requirements as possible.

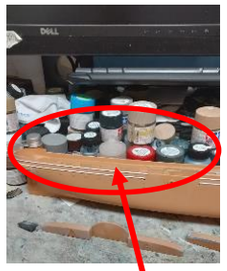
Identified problem:

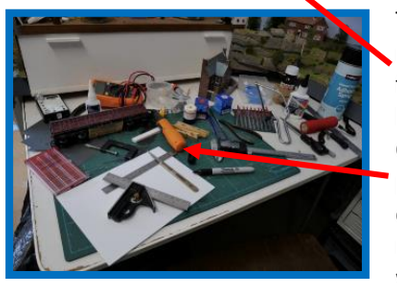
Here you can see a problem which both I and many other modellers experience when in the middle of a build. Due to the size of the workspace/desk and the amount of equipment and paints needed for one build the space we are able to work in gets very limited and the workspace gets very messy.

This also means there isn't any space to leave things to dry or even have the instructions visible when building the model

While there are solutions to this problem out there many of them tend to be bulky and still take up a lot of the work surface needed.



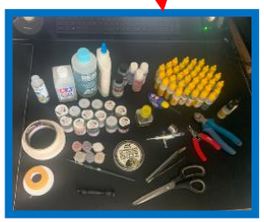




This is all the equipment that I currently own for my modelling. As you can see paint is the main factor that needs to be addressed as they take up lots of space.

Other genres of scale modelling also have this problem whether it be Warhammer with all the different specific paints or railway modellers who need specific tools to fix the railway carriages which could potentially break over time. A large amount of storage is needed.

Every year there are many craft shows where people take and display/sell their hobby/craft for other people. When people go to craft shows they need a way of taking their; equipment, glues and paints, etc, in case a display gets damaged or to show how they do their craft. This means they need an efficient way of moving them around and storing it so it can be easily accessible.



Challenges to be solved:

1) Modelling equipment takes up a large amount of room and overtime your collection of paints and tools get bigger and bigger. If there was a compact way of storing paints and tools away this would mean there is a larger surface space to actually work on the models.

2) Equipment and paints need to be moved around to models shows and groups/societies. This means a compact and light-weight storage/transport case would be helpful to easily move around and store many different types of tools and paints.

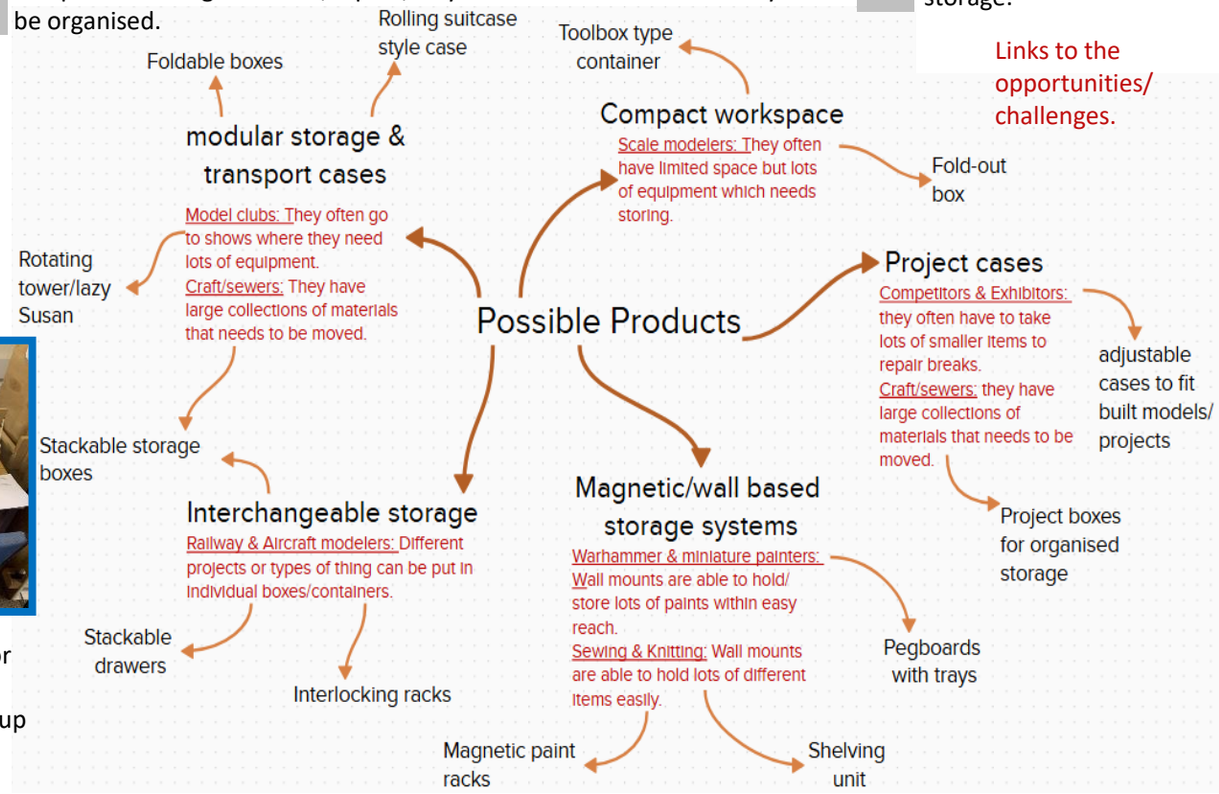
3) Many different projects could be happening as the same time so the pieces or equipment needs to be kept together which can be quite difficult and pieces could get lost. So, if pots, trays or boxes are used then they can be organised.

Opportunities:

There are many people who would have a use for a product like this. There are many local model clubs up and down the country and also globally. Along with all the clubs there are many different types of modelling genres including Warhammer, railways, Aircraft , vehicles etc.

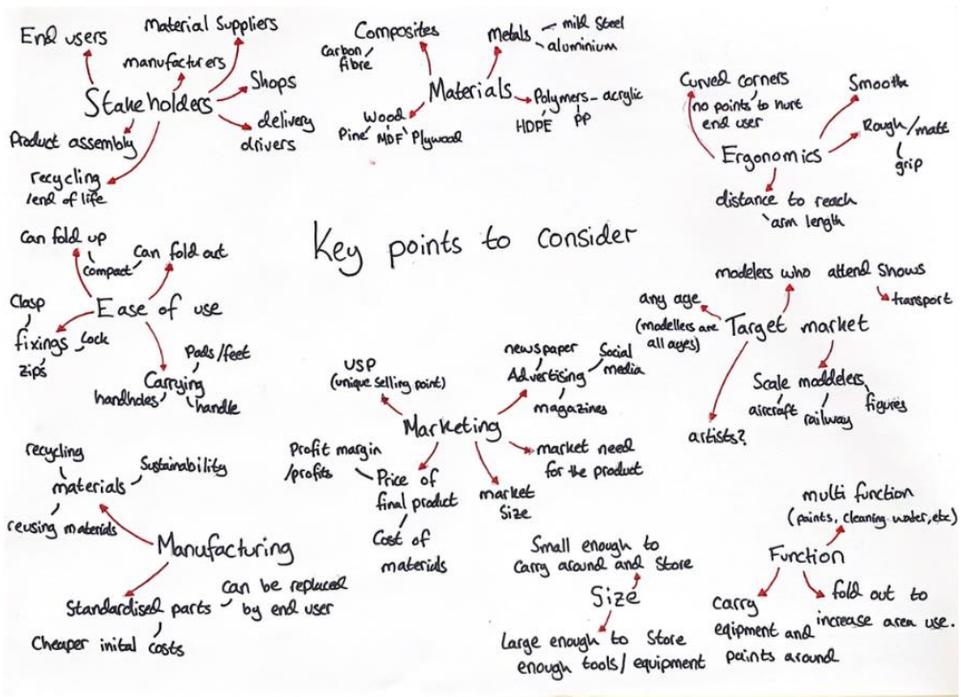
In addition to scale modellers many other hobbies need storage have many different tools and equipment. These could include sewing, knitting, cross-stitch, card making.

All these different hobbies have very similar needs; they need a clean area to work, large storage area, organised storage.



Personal link:

Outside of school I am an avid modeller and paint model military aircraft. As a modeller I collect many different paints, brushes and equipment and storage and organisation becomes a major problem. This becomes a problem when you also need to use the desk/workspace for other things like work or other hobbies. With this in mind I could design something that has storage for many different items as well as being compact to be easy to carry/more around. And to be able to be stores in different places.



Summary and next steps:

Here I have looked into the context of my project and I have explained the problems in my personal hobby which many others encounter . Next I will come up with a design brief and look in more depth at some possible products

Investigation of the context 2

Marketing:

My final product will need to be marketable. This means the product will both have to attract people's attention in its looks and style, as well as useful, practical, and/or innovative. Along with this a strong brand identity will be key to making the product a success. Different marketing techniques; such as billboards or digital adverts can all be used to spread awareness of the product.

Possible end user:

A possible end user would be someone who is into a model or craft hobby and has a large collection of different tools and equipment, and has a problem storing them away and having a large enough workspace to work on their current projects

Stakeholders:

- Material suppliers - (colliers, bare-wood ltd)
- Manufactures of parts (CNC companies, metal workshops, wooden parts manufacturers)
- Physical/online shops (amazon, airfix.com, scalemodelshed, mannsmodelmoments)
- Other hobbyists (scale model groups/societies, aircraft modellers, figure/Warhammer modellers, railway modellers, knitters, sewers, card makers.)
- Delivery companies (DPD, royal mail, FedEx, UPS, Hermes, etc.)
- Recycling companies (Grundon) - allows all parts of the product to be used in other products

Possible products - SWOT analysis

SWOT Analysis (tool box)
Strengths:
Can be ergonomic so comfortable to carry around, and many different compartments to store different things.
Weaknesses:
Can become heavy with all the equipment inside and needs to have extra protection on the corners to protect the items being carried.
Opportunities:
Most tool boxes are generic and they aren't/wont be many specifically designed for small paints or brushes.
Threats:
There are many different companies and brands that create different toolboxes of different sizes, costs, and protection 'levels'.

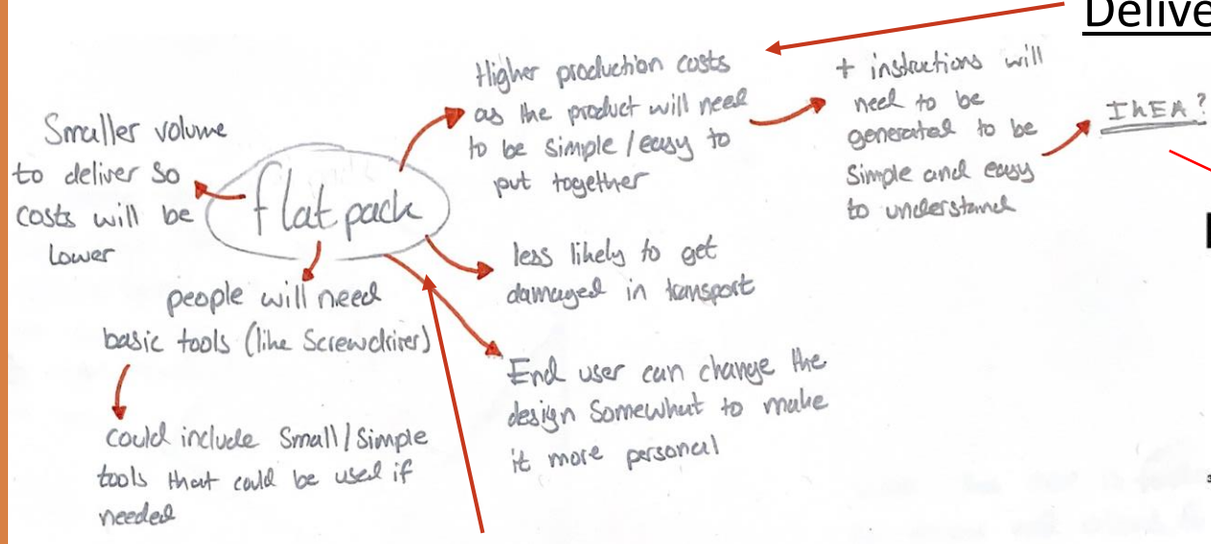
SWOT Analysis (fold out box)
Strengths:
Lots of storage as the parts fold out to show more organisation and paints.
Weaknesses:
Folding mechanism could be a liability and could easily break with misuse.
Opportunities:
Many tool box companies are now adding fold-out sections which means many are following this trend
Threats:
Many tool boxes could be used to transport the same equipment, but not as efficiently

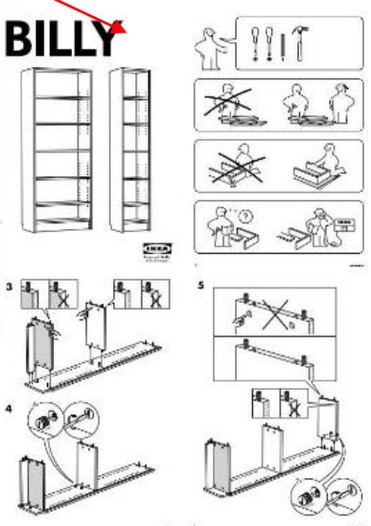
SWOT Analysis (stackable storage boxes)
Strengths:
If stackable then the boxes can be stored vertically on top of each other and can be easily transported around via car or carrying
Weaknesses:
If stacked up then access to the lower boxes would be harder and make those paints less accessible.
Opportunities:
Recycled plastic can be used to limit the environmental impact of the product.
Threats:
Many tool boxes could be used to transport the same equipment, but not as efficiently

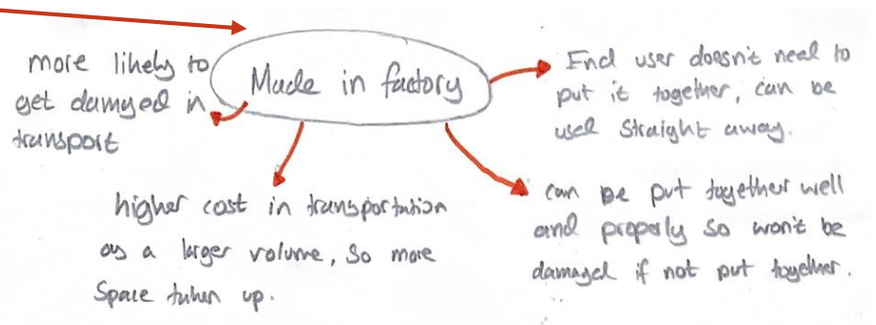
SWOT Analysis (lazy Susan)
Strengths:
Spinning mechanism allows more items to be stored in one place and still be accessible as the disk can be rotated to revel more paints/equipment. The rotation allows less spaced to be used for the same amount of stuff.
Weaknesses:
Equipment cannot be as easily/efficiently stored as they are not the same shape/regular shapes.
Opportunities:
Space efficient and improves accessibility
Threats:
Improvements in drawers means that drawers can be implemented into many spaces they couldn't used to be so a lazy Susan can be replaced by drawers

SWOT Analysis (Shelving units)
Strengths:
Lots of space can be produced/created **without** creating a bulky product that will take up lots of workspace.
Weaknesses:
Cannot be transported/moved around and may not be very accessible when sitting down.
Opportunities:
Many people have shelving in there house which could be repurposed/replaced with a specialised shelving unit for paints ad tools
Threats:
Any shelf could be used to store equipment and so the need for the product wouldn't be very high.

Delivery/Manufacture:







Later on, when I know the size, I will look into the cost of delivery by a company (such as DPD), and compare the price of flat pack vs prebuilt.

Summary and next steps:

Here I have looked into the marketing, possible end users and I have done some SWOT analysis on some possible products. Next I will look into the importance of end users and introduce the people who have agreed to be an end users for my project.

Investigation of end users

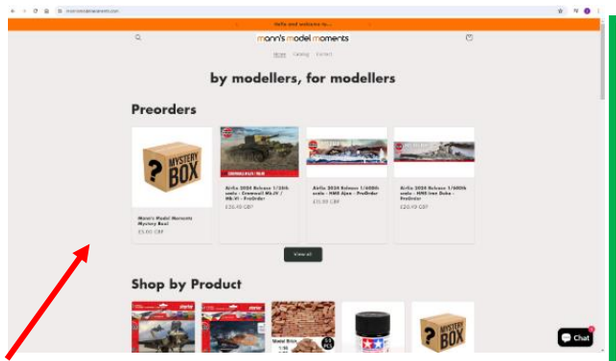
Design Brief

I will design a product which will allow a person with a craft or model biased hobby or passion to work on their project with all their relevant tools and equipment stored efficiently, allowing a larger workspace to be created, and allowing the equipment to be moved around easily.

Design Brief Commentary

As the popularity for hobbies and crafts grow there will be more and more people taking to modelling, sewing , knitting etc. this means that more people will be investing in a large supply of specific tools, equipment and materials for their chosen one. This means they will need a workspace and a place to store all their stuff.

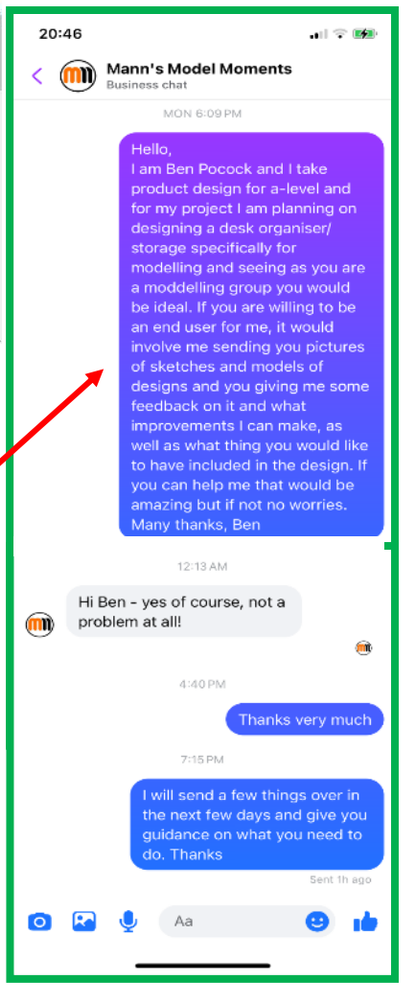
He also has a physical shop



This is alexanders model shop website, which could be a way in which I could sell my end product in. weather it is made for specifically modellers or for general hobbyists.

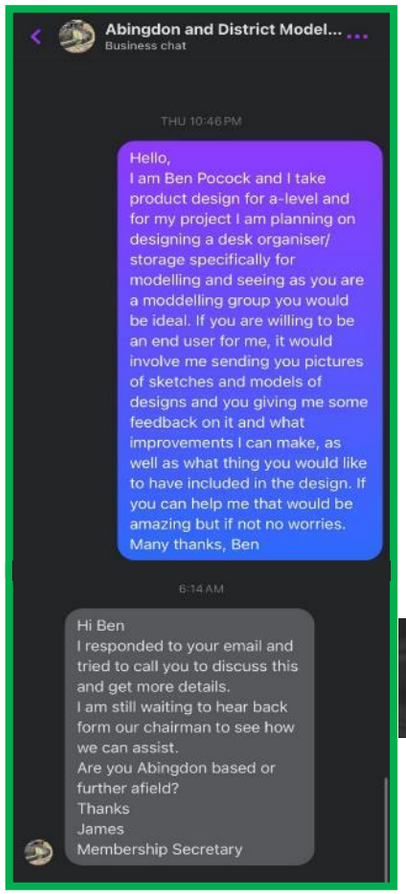
Right from the beginning I realised I needed to be in contact with potential end users. I sent out a few messages to 3 people/groups, two of which replied and were happy to help me out.

Here I have been in contact with a second local scale modeller and model shop owner who could would be another ideal end user as they could give feedback from the point of view of sales as well as a modeller.



Primary user:

My primary user(s) is ADMRC (Abingdon and district model railway club). Which is a model group which is made up from a whole bunch of railway modellers in different scales who meet once or twice a week and have personal and collective layouts. They are an ideal primary user as they regularly go to model shows and need to take equipment with them.



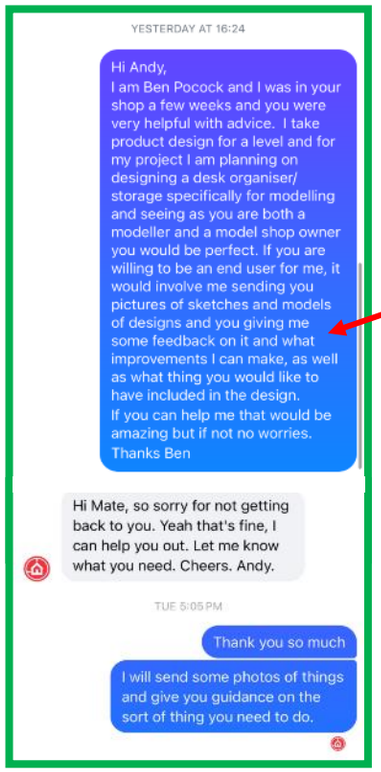
Here I have been in contact with a local scale model railway club which could possibly be a group of end users as well as a likely stakeholder in the products lifecycle as they would be the kind of people who would end up using the type of product I am designing.

Here I am at one of their weekly meetings at which I showed them my design brief and they gave me feedback and some ideas for designs as well as features that are needed in the design.

One stakeholder is Alex who owns both a physical and online shop. He is an ideal stakeholder as he can give feedback on how well the product can me marketed and shown.

Other stakeholders:

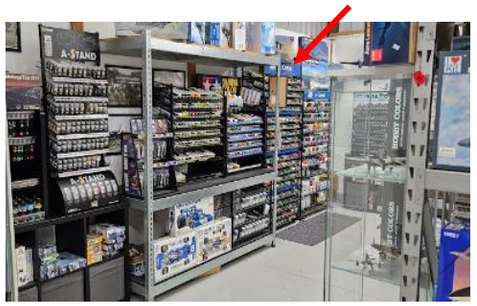
SCALE MODEL SHED



Another stakeholder is Andy who also owns model shops which is more specialised and is more focused on model aircraft. This will allow specific feedback from model aircraft focus.

Here is Andy's physical shop which he has in Devon.

Here I have been in contact with a local scale modeller and model shop owner who could would be an ideal end user as they could give feedback from the point of view of sales as well as a modeller.



Summary and next steps:

Here I have looked into to my end users and introduced them. Next I will show a list of end user and stakeholder requirements for my project.

Other stakeholders

Need and requirements

Delivery companies

- Durability – packages must be strong enough to be stacked up and to withstand handling.
- Size and weight – some companies will have weight and size requirements which will limit the size of the product. (product needs to be lightweight).

Manufacturers

- Durable materials – the manufacturer will need to obtain/use strong and lightweight materials which are suitable for mass manufacture.
- Clear design drawings – Detailed CAD drawings or models showing dimensions and materials. This allows them to accurately and quickly create toolpaths to manufacture the product.
- Precision manufacture – Capacity to manufacture parts to a high detail (small tolerance) to allow parts to friction fit and also slide past each other.
- Standard components (where necessary) – the use of standard components will make the manufacturing process easier as they won't need to made and can just be added in.
- Modular design – makes the manufacturing process easier as parts can be cut out separately and the joined together, rather than fewer more complex shapes (which would take longer to cut out.

Disposal companies

- Clearly identifiable materials – to reduce time taken to process the product the material could be engraved into the product for easy identification
- Modular design/assemble – makes it very easy and simple to break down the product to be disposed of.
- Recyclable materials – makes the product more sustainable and minimises the waste produced.
- Minimal mix of materials – makes it easy to get rid of as only made from 1 or 2 different materials.

Sell it (shop/online)

- Interest for product – the shop will need a want for the product for it to be able to sell.
- Fill a gap in the market – if the product is too similar to other items then it won't be able to sell
- Profit margin – the mark-up on the product needs to be high enough for the company to feasible sell it while also making it affordable for the consumer to buy.

Summary and next steps:

Here I have looked into general stakeholders and whet needs and requirements they have towards a product. This will help in the later design of the product I choose. Next I will make a list of requirements that my product should fulfil.

Investigation of end users and stakeholders needs and wants

Requirements	Identified by	Explanation/justification for including the requirement
Large capacity	ADMRC member, Me	Large capacity allows lots of equipment and tools to be moved around and taken with the user to different places.
Lightweight casing	Me	If the carrying case is lightweight then even if it is full of heavy equipment then it will still be portable and be able to be carried around
Organisation methods are included	ADMRC member, Me	Mechanisms such as drawers are fixed inside the case to allow easy storage of smaller items
Plug sockets/an electrical supply	ADMRC member, Me	Some hobby tools require an electrical supply and can have short cables. So, a plug socket would allow to tools to be used in the designated workspace.
Battery charging	Me	Many tools also use batteries which can run out while being used, a small area which can used for charging up batteries/a USB block.
lighting	ADMRC member, Me	Some crafts have intricate parts which need a good light source to do well so a source of light could be included.
Portable	ADMRC member	many hobbyists don't like to do their hobby in one place. Making the product portable means that they can pick it up and move it to the place they want to carry on with it.
Secure water seal/weather proof	Me	If the carrying case is being moved/transported it needs to be somewhat resistant to the weather/water.
Made from sustainable materials	Me	If the product get mass manufactured then its impact on the environment would be low.
Durable	Me	Due to the case being carried around and placed down the material and build needs to be durable enough to withstand misuse and damage.

I discussed some requirements with my end users after going to see them. After explaining my project and brief the them. They helped my come up with a list of requirements that would make a suitable product that would be useful to have, easy to use and innovative.

Out of this list I have come up with two lists; Master list (main requirements), Secondary requirements (possible features).

Master list - (the main requirements which will be included in the final product) :

1. Large capacity

↘ Can include all of the important equipment such as a vice for holding models; all the wool or yarn for knitting; or all the different types of paper and equipment for card making.

2. Lightweight casing

↘ The case (product) needs to be lightweight so that when filled full of the equipment and materials for the different hobbies it can still be easily carried/moved around .

3. Organisation methods are included

↘ Mechanisms such as drawers, shelves, etc. to allow a large space to be neatly organised.

4. Lighting

↘ many of the hobbies use small and fiddly pieces and equipment so a source of bright light will allow the user to see what they are doing more clearly and will mean they can do the hobby in darker spaces.

5. Portable

↘ many hobbyists don't like to do their hobby in one place. Making the product portable means that they can pick it up and move it to the place they want to carry on with it.

6. Durable

↘ Due to the case being carried around and placed down the material and build needs to be durable enough to withstand misuse and damage.

Secondary requirements - (requirements that will not necessarily be included but if suitable then will be):

~Plug sockets/an electrical supply

↘ Some tools in the hobbies require a power supply and they cables may not be very long so sockets in the case allows they to be used in the work area created by the product.

~Battery charging

↘ Many tools also use batteries which can run out while being used, a small area which can used for charging up batteries/a USB block.

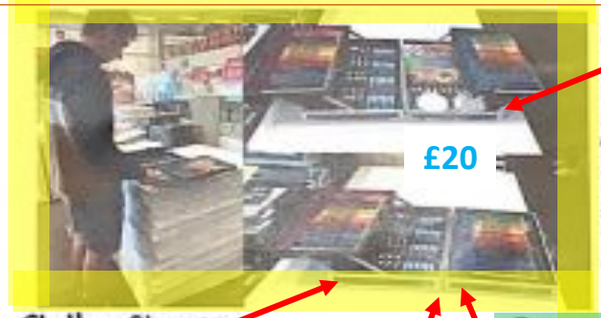
~Sustainable materials

↘ sustainable materials cost more to manufacture and are sometimes harder to come-by possibly making the product more expensive, but with the negative environmental impact.

Summary and next steps:

I have now come up with a list of requirements from my end users which my product should fulfill. Next, I will look at some products that already exist and how they can be improved.

Investigation of existing products (primary)



Folding arm allows for more compact Storage, but the arms are only made from a thin piece of metal so not very Sturdy

Shallow Storage - unable to fit larger items but good for brushes or pencils.

Portable - the product folds down and has a handle to carry it.

Shell made from plastic and reinforced with metal, lightweight but durable

Use of Standard box - cheaper than a Specialised product.

too small to hold enough equipment

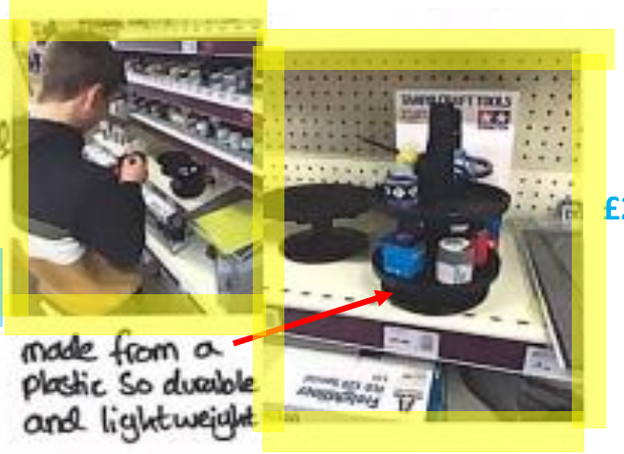
Small design allows for portability.

Seperate compartments allows for Simple organisation

Thin wood makes it harder to join

This product is it's self an organisation method, rotates to allow more Storage

Could be included in another design?



made from a plastic so durable and lightweight

not weather proof as it has no cover

large internal capacity allows larger and heavier equipment to be Stored.

large handle allows for easy portability

includes a Sholder Strap - easy to carry when full.

made from fabric - the bag is lightweight.

2 draws - Small capacity - could have multiple to increase Capacity

no handle so not portable

draws are deep - so good for tall items but small items could get lost

No finish, so wont be protect against water/weather.

Thin, lightweight wood means it's lightweight but not durable

Suitable for different types of equipment (thin & bulky)

Easy to use - lift out Shelf can be removed for more Storage.

Seperate compartments allow organisation of Smaller/Similar items

lots of pockets for Storage of different equipment and organisation

metal frame and fabric creates a durable bag.

The fabric needs to be sewed together securely so that it can carry heavy tools. But the fabric allows to it be lightweight at the same time

Portable - as it contains a handle to carry it with.

Lightweight - made from a soft wood and & thin walls.

Sturdy joins (finger joints) means it is durable.

The wall are thick enough to add a hinge and joint the walls together

Small Storage - doesn't hold many things.

Multiple types of Storage:
- taller containers for brushes or pencils
- trays for taller items like pots of paint
- draws for smaller/thinner items, like cards or pins.

Lightweight - made from pine so doesn't weigh much.

Not very portable - no way to carry it

Thin wood makes the product lightweight but would make it harder to join two sheets together. It is doable but takes more time and is more expensive.

After a trip to Hobbycraft I which I had a look at some of the existing products available in the market, and a visit to one of my stakeholders ADMRC, I found that there were a large variety of different types and sizes of products in which organisation can be achieved.

My personal visits

Key points:

- Large variety of sizes of storage, means that lots of different items can be stored
- Many different pieces of equipment is needed as lots of different tools are used including hand tools, power tools, and precision tools
- Folding out storage is great for compact storage, but not ideal for larger items and can be unstable

Summary and next steps:

Here I have been to a few places and found some similar products that could fit my design brief. Next I will find a few more products online that could also fit the design solution.

Investigation of existing products (secondary)

different types of storage (brush holders, large boxes

£312

Quite expensive for what it is

not too heavy as made from fabric

boxes can be taken out and use elsewhere.

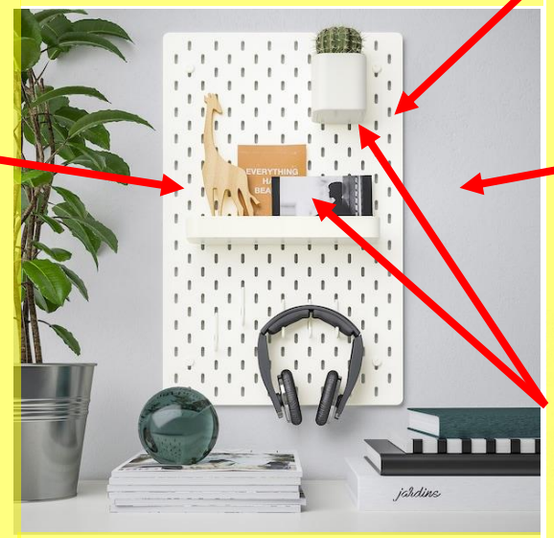
Easy to move around as it is on wheels

Large - can fit lots of items, possible impractical.

Allows for compact and efficent storage as different shapes and sizes can be attached.

£10

very cost effective.



not portable as it has to attached to a wall.

modular design, can be stacked up next to each other to expand the size.

Can be used for many different things (boxes, trays, pots can be attached to it).

wooden top surface makes it look aethtetic and something that you would want to have around.

Includes a worksurface ontop so project can be moved around with it.

made from metal so very durable

Options for different storage (organization drawers or cupboard)

£659.99

On wheels so very easy to move around inside.

Small and Compact, easy to carry and move around.

Small fold out handel makes the case very portable.

top section allows for more storage of different items.

£103

Easy to use as it is intuative with drawers and handles.

Due to it's size and weight it will be difficult to take many other places.

drawers only allow for certain storage, thinner tools and flat objects.

made from thin metal so very strong as well as being lightweight.

Key points:

- Different types of storage is popular (allows for different items to be stored
- Wheels could be a good way of moving larger items around while also keeping them able to be stopped and used
- Making it out of metal sheets makes it lightweight while also giving it strength and structural integrity.

Summary and next steps:

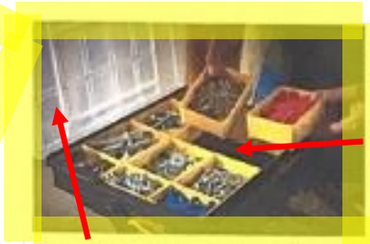
Here I have looked online and found some similar products that could fit my design brief. Next, I will find some more products online that could also fit the design solution.

Investigation of existing products (secondary)

I had a look online for other different products that can also fulfil the brief.

£20

Large storage - fold out compartment allows for more storage.



See-through lid allows a clear view of items inside the container

Removeable boxes - Ease of use, can take the box you need rather than the whole container

tight fitting lid allows the product to be water tight.

made from a durable plastic - lightweight casing and durable material.

folding up and handle allows portability.

£15

different container sizes for different objects

relatively small containers, so difficult to move around as a set

Used standard fixings means that it can be easily replaced if broken

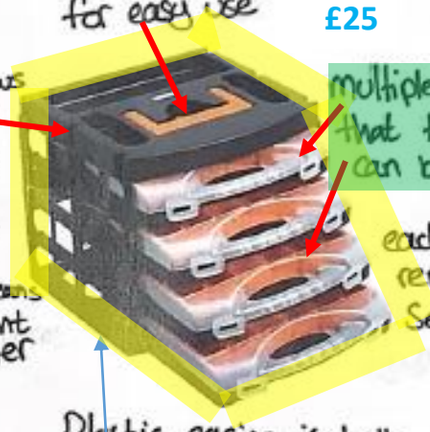
Plastic - durable material

made from plastic - Lightweight material & waterproof.

handle ontop for easy use

£25

Plastic frame allows efficent, lightweight storage of the different boxes.



multiple boxes means that tools and equipment can be organised.

when designing my product I could include something similar to this.

watertight - each box used Clips which means it is resistant to water

each box can be removed and used seperately

Plastic casing is both durable & lightweight - due to the use of a hard plastic

Extreamly large storage - many different storage solutions allows for many different types of items to be stored.

Modular design - layout can be changed and reorganised for the needs.

Large workspace created by the design of the organisation solutions.

£350

no way of plugging in equipment to use in the workspace - would need longer cables to use the tools.

Not portable

Could be something that could be added?

The plastic is prefinished meaning that is does not need an extra finishing before use.

Large storage at the top for larger items such as bottles or electrical equipment

handle ontop for easy moving

Strong Clip allows secure storage & transport

Many smaller trays /organisation methods are included for efficent storage

£30

Key points to use in my design:

- Smaller, removable pots or trays are very useful as they are able to be removed and used elsewhere while also being compact storage to organise small pieces
- Different sizes of pots or compartments are common as different items need different size things.
- Large handle or strap for easy carrying if the product is portable, ergonomic plastic handle?
- Most of the portable designs are made from plastic, which can be cheap and easy to manufacture quickly.

Key points:

- Many items are made from a plastic, which is both lightweight and durable, so my final product could be made from a plastic.
- Small removable drawers are ideal for easy organisation-removable cases which can then be used separately
- Large padded handle should be included to improve the user experience
- Different organisation methods for storing different items (hooks, drawers, shelves, pots)

Summary and next steps:

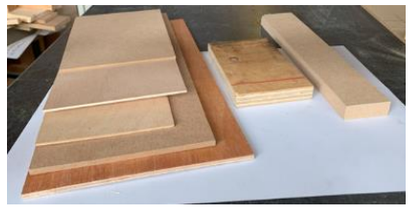
After looking at products that currently exist on the market, I have found some properties/functions that I could use/incorporate into my design.

Materials research

MDF

Ease of construction:
- Easy to cut and work with
- Easy to join with screws and nails
- Edges need to be sealed
- Sensitive to moisture

Available forms:
Large sheets:
2440мм x 1220мм in thicknesses of
6мм, 12мм, 15мм, 18мм



Finish:
Paint, wood veneer.
Not many finishes work as it is a manufactured board.
MDF needs to be sealed on it's sides as they are venerable to water/moisture.

Cost:
For large sheet material: £8 - £12 per m²

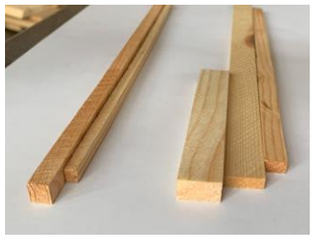
The cost of MDF is relatively cheap compared to other materials as it is a manufactured board.

MDF is suitable for use in my product as in out workshop we have all the tools and equipment needed to use MDF as well as it being easy to work with and cheap to obtain.

Pine

Cost:
For large sheet material: £15 - £30 per m²

The cost of pine is relatively expensive compared to other woods but not as expensive as some hard woods.



Ease of construction:
- Easy to work with
- easy to join (screws, nails, glue)
- decent strength-to-weight ratio - thicker material needed for better strength.
- simple tools needed to cut (so can be easily worked with at school)

Available forms:
Plank, boards, rods.

There are other forms it comes in but the won't be helpful in my designs.

Finish:
Paint, varnish, stain, wax.
Many different types of finishes to allow the desired finish to be achieved.

Pine is suitable for use in my product as it is cheap to buy, easy to use, and has a large variety of finishes that could be used on it. This gives it a large window of use in a large variety of products.

Summary and next steps:

Here I have looked into different materials that I have available to me and which I could use to make my model and prototype.

Next I will start coming up with some initial designs that fit in with my brief and master list while taking onboard things I have gained from existing products

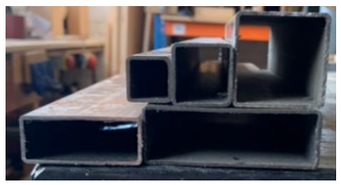
Mild steel

Mild steel is relatively suitable for use in my product as we have the necessary equipment needed to work with it, such as brazing kit. May not be ideal depending on the design complexity.

Ease of construction:
- Easy to cut and drill
- easy to join (brazing and welding)
- relatively easy to bend/shape

Available forms:
Sheet, bar, rod

Finish:
Can be painted, powder coated, galvanized, or electroplated.
there are lots of different finishes that can be used to get the finish required.



Cost:
Sheet: £30 - £120 per m²
Bar: £5 - £20 per m²

the cost of mild steel is quite expensive compared to other materials

Polymers

Both polymers are less suitable to use and we don't have the equipment to manufacture and mould them, which would mean that it would be difficult to make final solutions and also make modifications.

Thermo

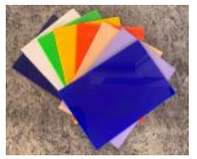
Ease of construction:
- Remouldable
- Simple tools needed
- Easy to clean
- Easy to join

Finish:
Pre-finished so doesn't need any extra finishings.

Cost:
including all the different forms; the cost is around £0.80 - £3.50.

Available forms:
Sheet, rod/tube, granules, powder.

Thermoset



Cost:
including all the different forms; the cost is around £2.40 - £6.40.
This is more expensive than thermo-polymers.

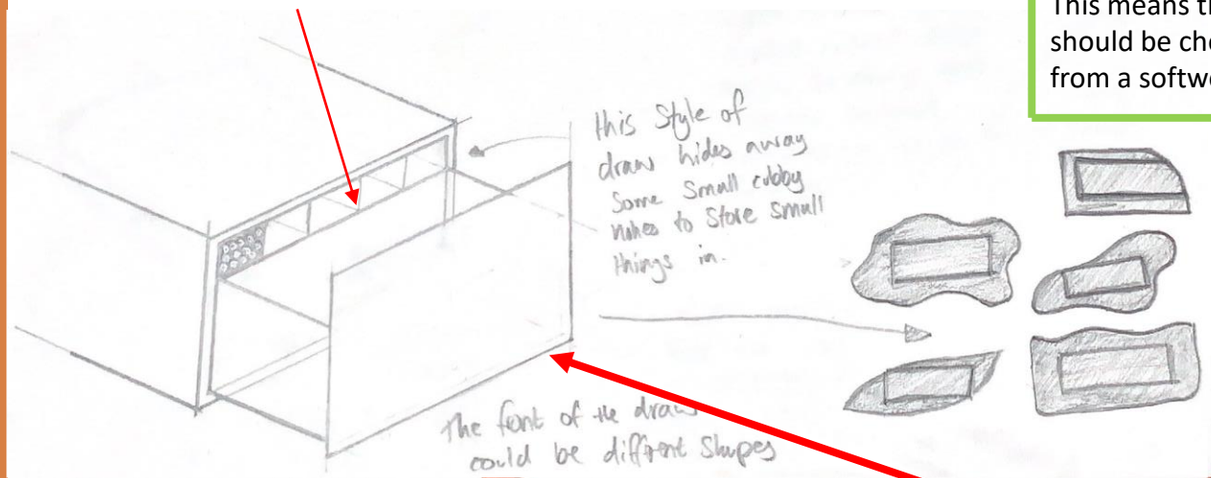
Finish:
Pre-finished so doesn't need any extra finishings.

Available forms:
Sheet, rod/tube, granules, powder.

Ease of construction:
- Rigid
- time sensitive
- difficult to join when set

Initial Idea 1

Hidden shelves/cubby holes could be used to store brushes or pencils/pens

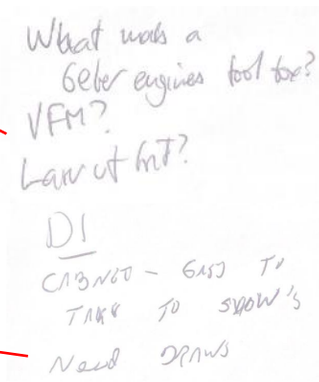


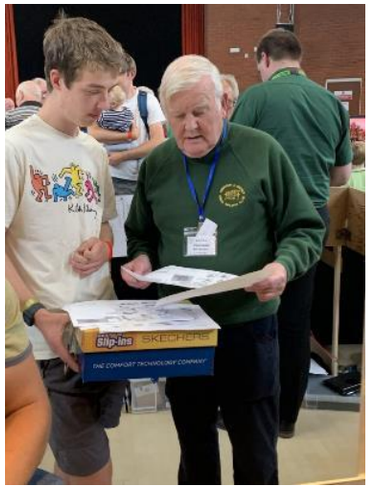
The box would need to be made efficiently and cost effective, as to be able to bring the price of the final product down.

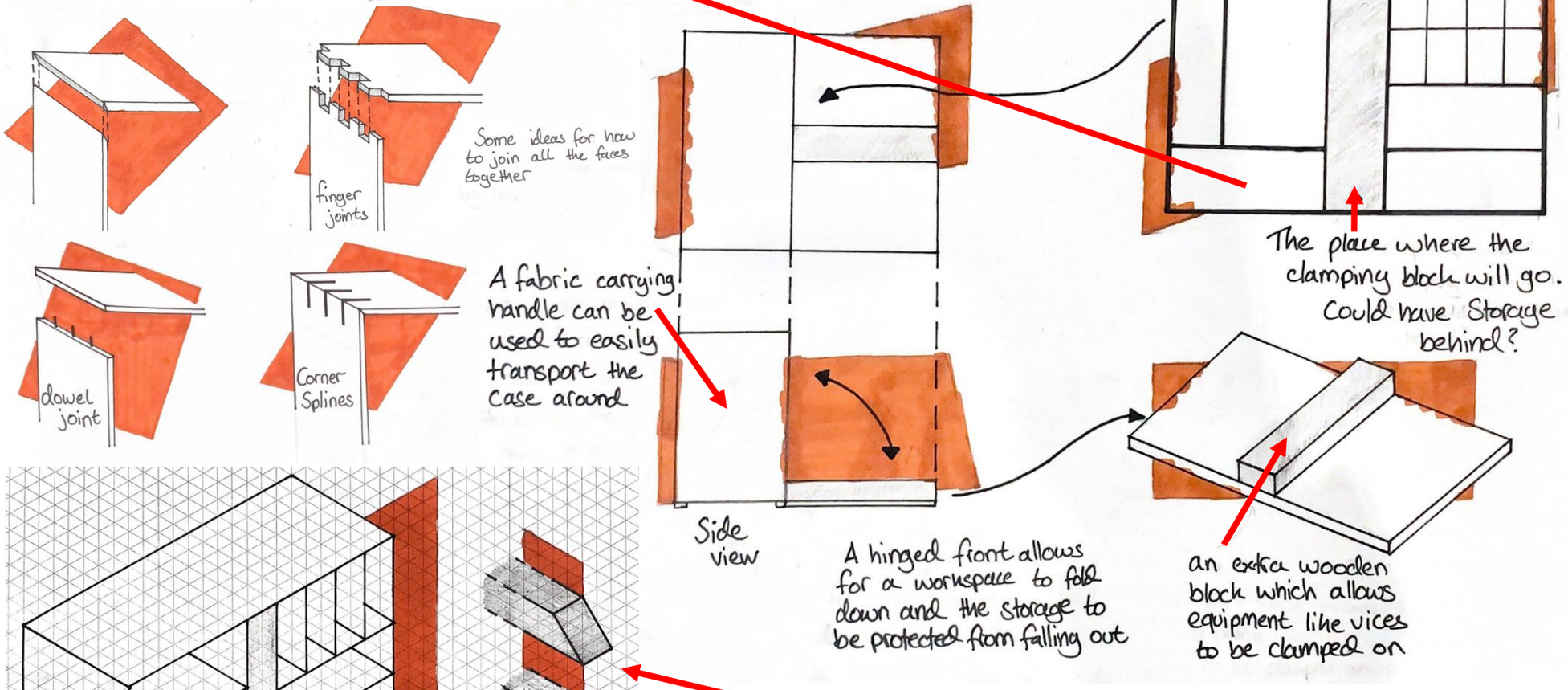
This means that the material it is made from should be cheap to source, so could be made from a softwood or a manufactured board.

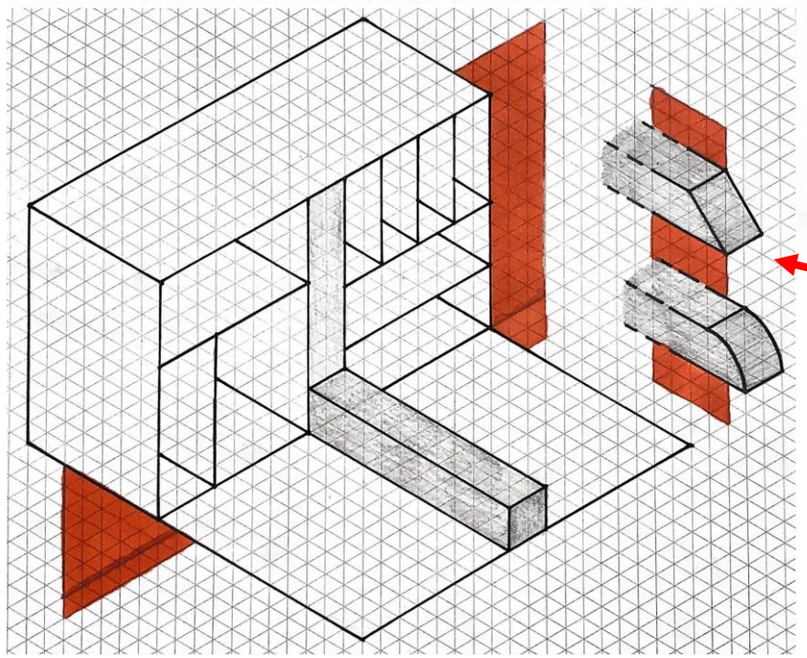
In response to this feedback I have added drawers in place of the shelves so that the items don't fall out when moved

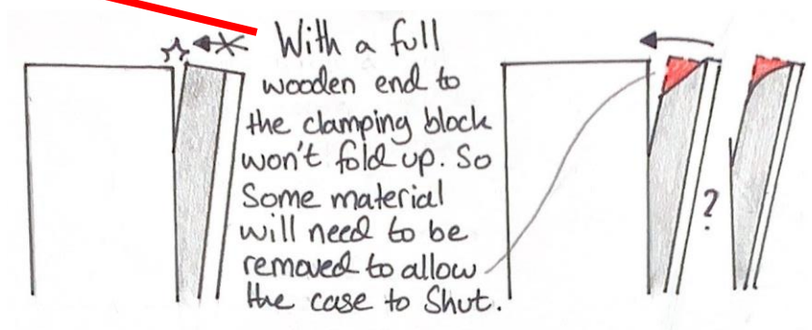
FEEDBACK:





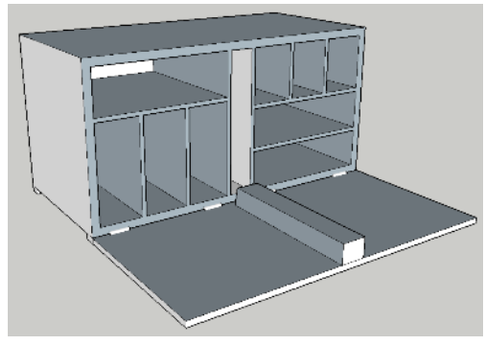






Master list-Response

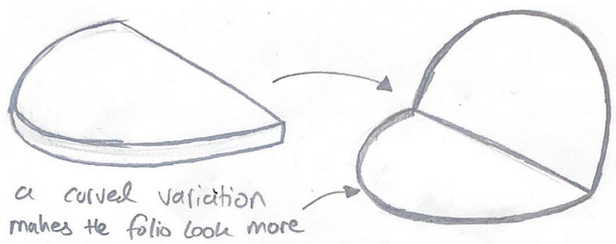
1. Large capacity- with the design having many shelves and drawers the case can carry many items
2. Lightweight casing- This could be looked into more when iterating and improving the designs, with testing of different materials
4. Lighting- not yet incorporated but could be looked into when iterating the design.
5. Portable- if a carrying handle or strap is added to the design it will make it easy to move around
6. Durable- again, should be looked into when choosing the material for the design and how the material can withstand bumps and misuse



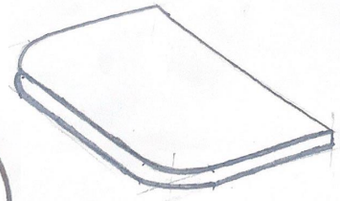
Summary and next steps:

Next I will come up with a second design which fits the brief and is different to this design.

Initial Idea 2

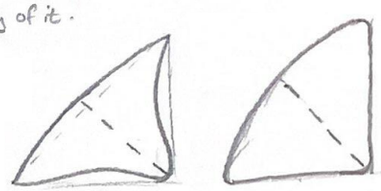


a curved variation makes the folio look more pleasing, but it might potentially loose some of the functionality of it.

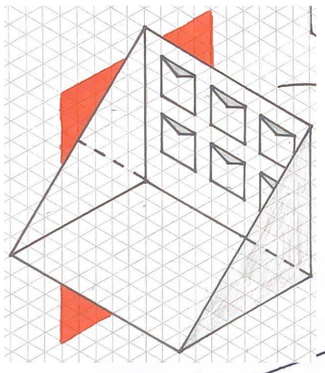


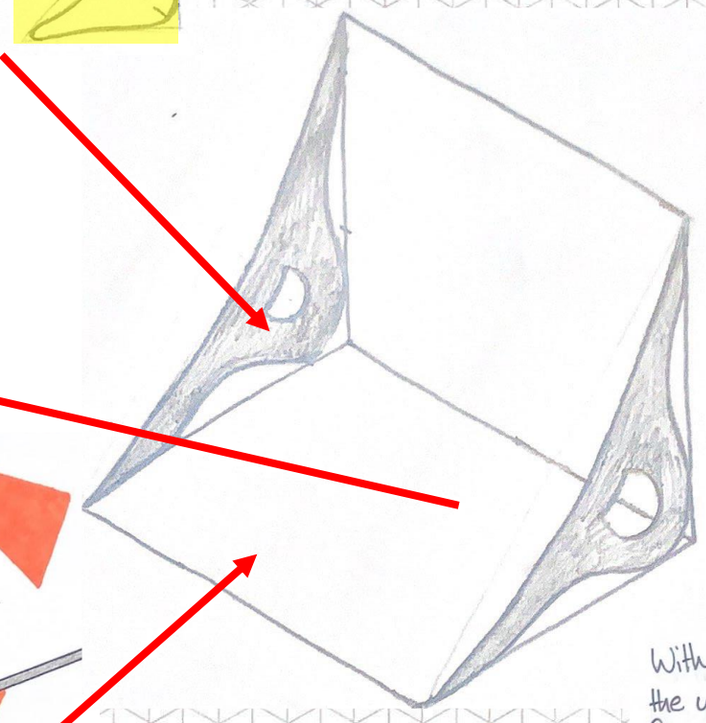
rounded-off corners allows for a mid-point between the curved and boxy design.

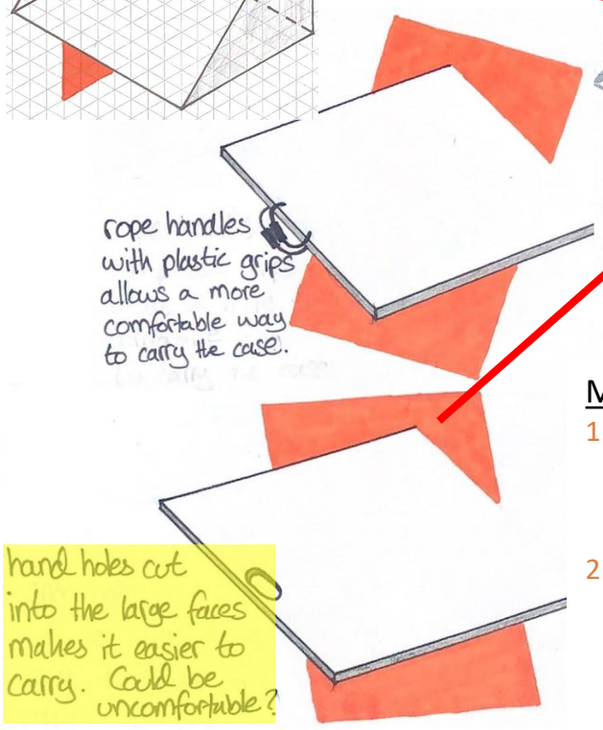
Some designs for the side 'mesh' a more curved design makes the design more aethetic without compermising on the function



When manufacturing these more complicated design there will be more wastage and would take more time - compared to the basic one which can resilate.







rope handles with plastic grips allows a more comfortable way to carry the case.

hand holes cut into the large faces makes it easier to carry. Could be uncomfortable?

Feedback:

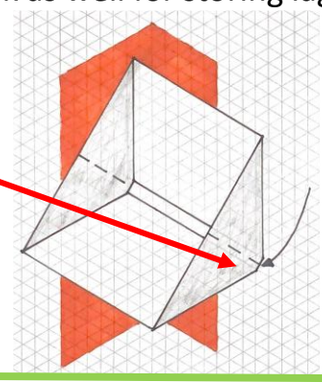
Folio

Really interesting use for storage the outside

→ sheet
→ ship
- small compact

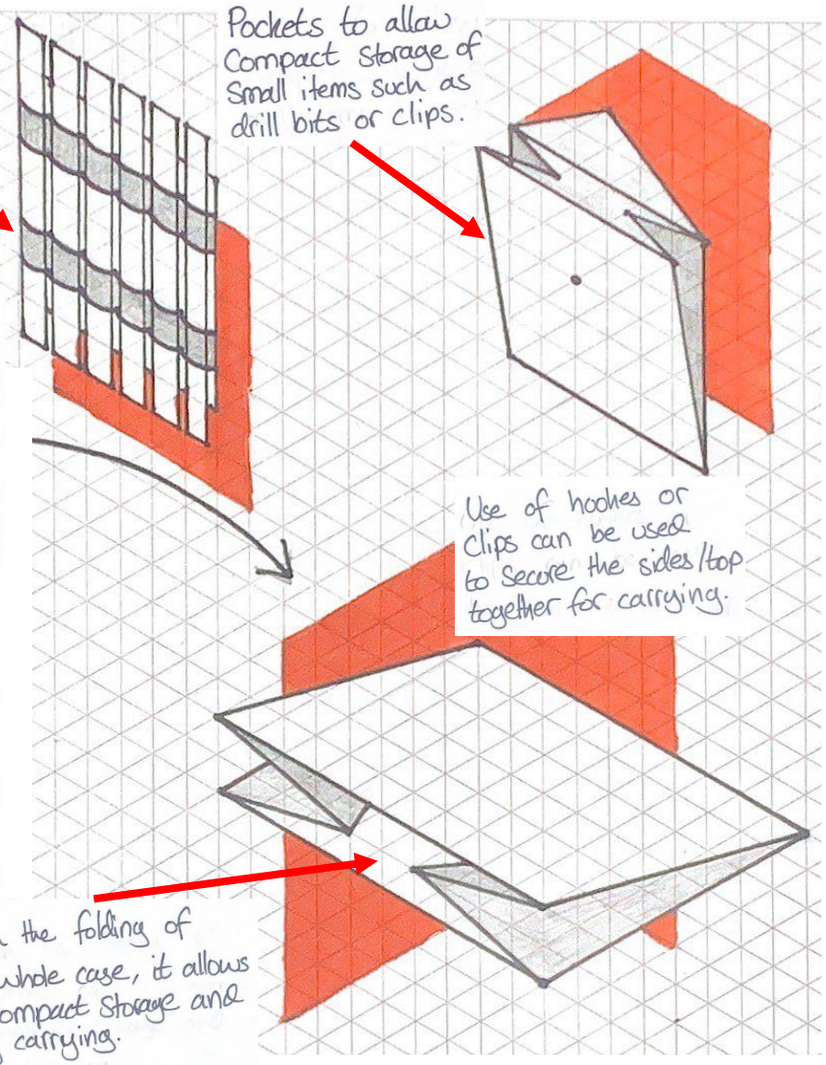
Works well for storing flatter items such as sheets of card or plastic but won't work as well for storing lager, thicker items.

Is there a way of making the design suitable for larger items? Such as making it more of a book spine so it doesn't fold up as flat.



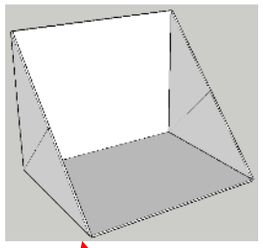
Elastic strips allows longer tools, such as brushes, pens or needles to be stored.

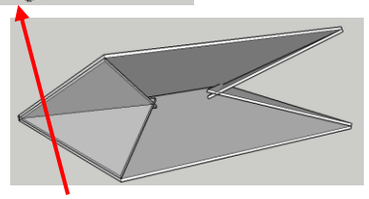
Pockets to allow compact storage of small items such as drill bits or clips.



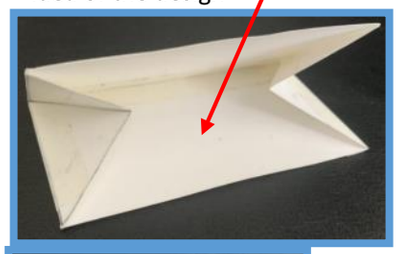
Use of hooks or clips can be used to secure the sides/top together for carrying.

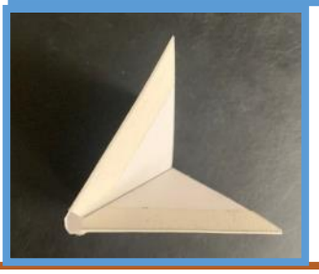
With the folding of the whole case, it allows for compact storage and easy carrying.





Here are some of my Cad drawings and some simple models to get the idea of the design





Master list-**Response**

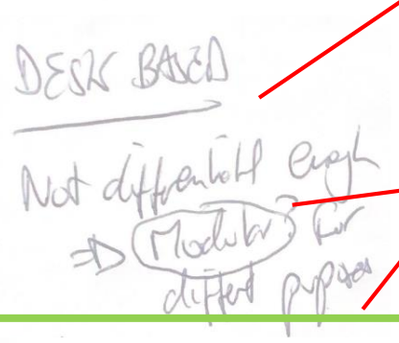
1. Large capacity- with the flat folding design it has a relatively small capacity with only being able to store flat or small items.
2. Lightweight casing- This will be looked into when iterating but at the moment the base and back could be made from a wood with the sides being made from fabric.
3. Lighting- not yet incorporated but could be looked into when iterating the design.
4. Portable- the folding design is very portable with a handle and small form when folded.
5. Durable- if the design was made from thin wood and fabric then wouldn't be very durable, so would need to be looked into or improved with further designs/ iterations.

Summary and next steps:

After coming up with a design that works well for flat materials but not for smaller parts, I now need to design a product that has larger storage for smaller parts.

Initial Idea 3

FEEDBACK:

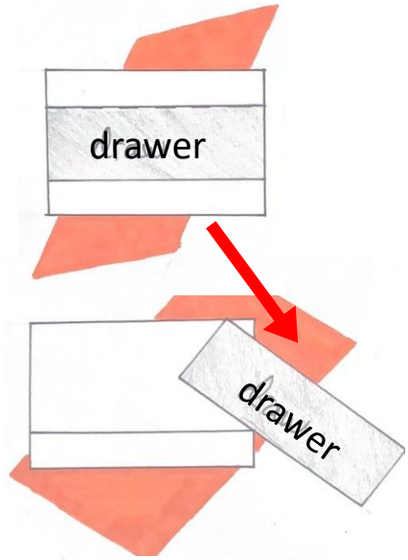


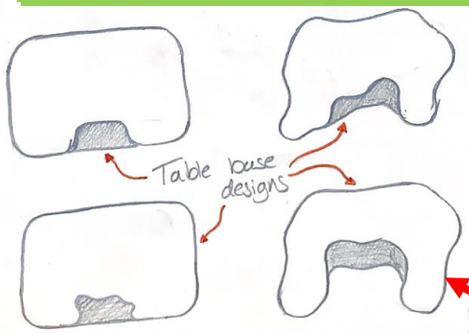
There are a few sort of similar products that exist but mine is different with the interchangeable centre box with a variety of different functions that can be placed there

If the product were to be sold it could be sold with a table with a certain size and then a selection of different types of storage or shelving they could be picked from to make the desk more personalised and more specific to the person.

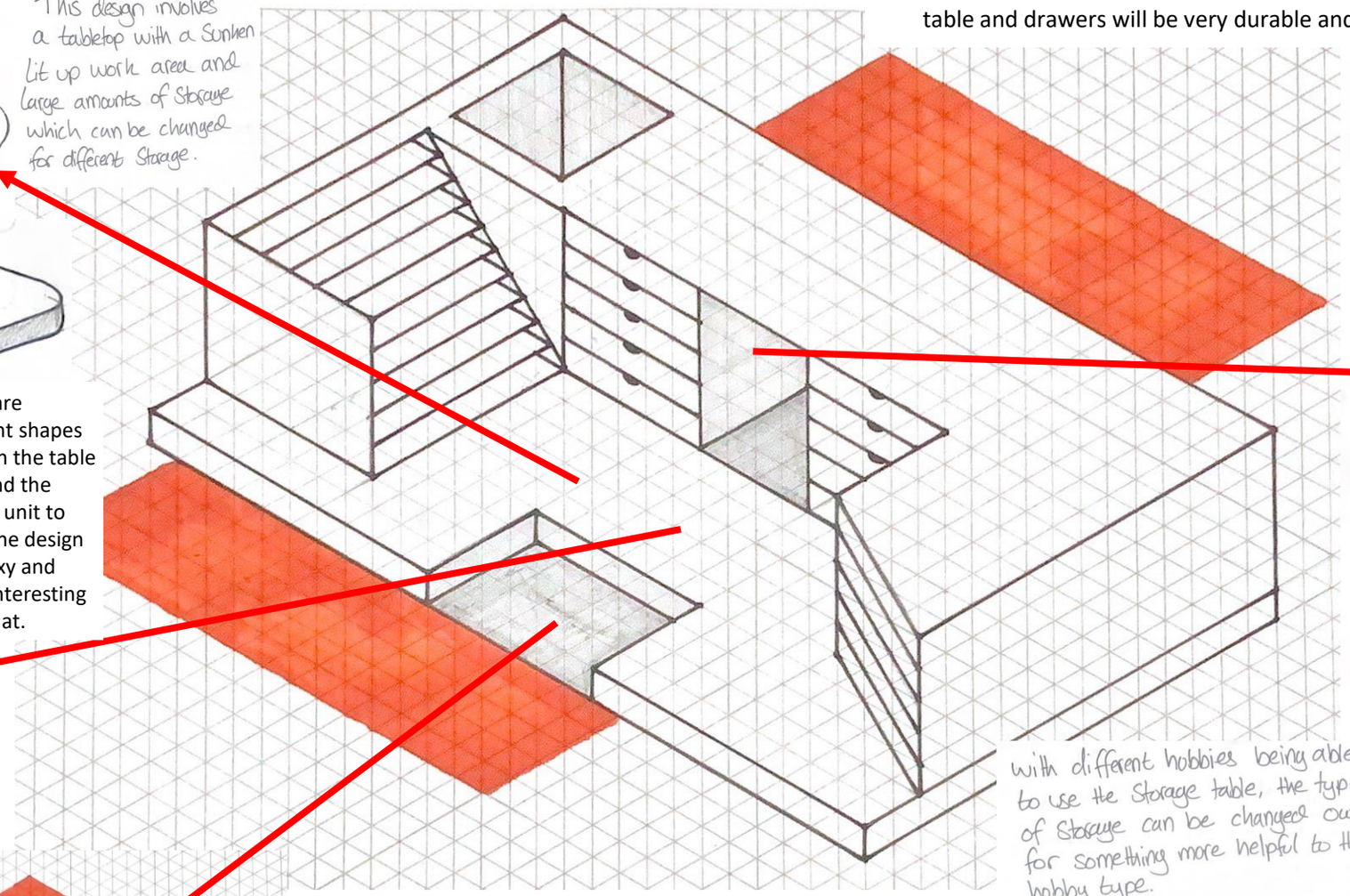
Master list-Response

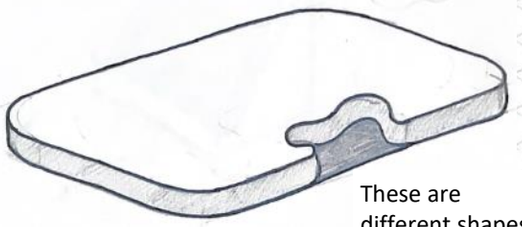
1. Large capacity- with design being desk based it means that there is a large amount of storage at can be easily accessed and used.
2. Lightweight casing- This design in not lightweight and cannot be moved around as it if heavy and fixed to a desk.
3. Lighting- there is lighting around the workspace to allow a better view of what you are doing. More lights could be added around the design in necessary.
4. Portable- the design in not portable and cannot be carried around.
5. Durable- the design should be made durable and if made from a metal frame and a hardwood then the table and drawers will be very durable and strong.



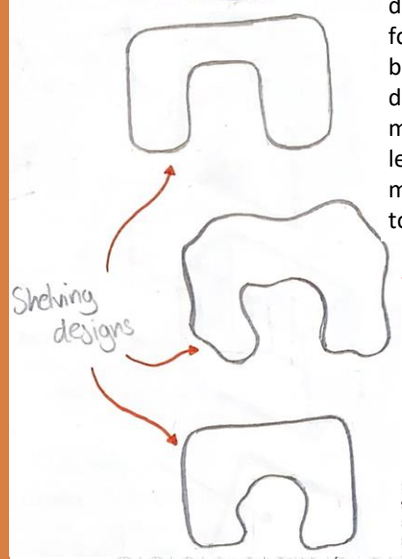


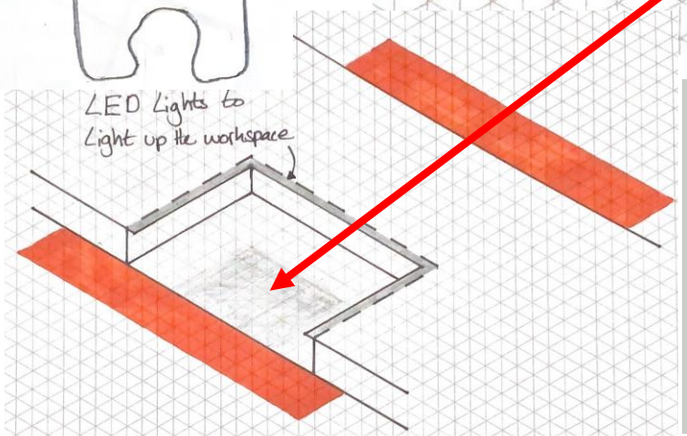
This design involves a tabletop with a sunken lit up work area and large amounts of storage which can be changed for different storage.

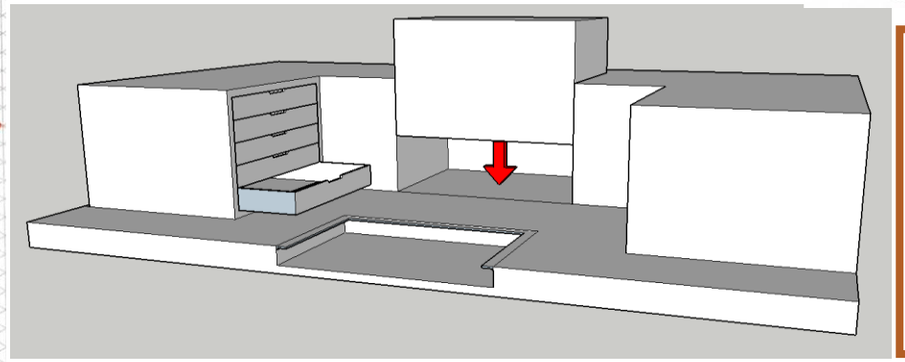




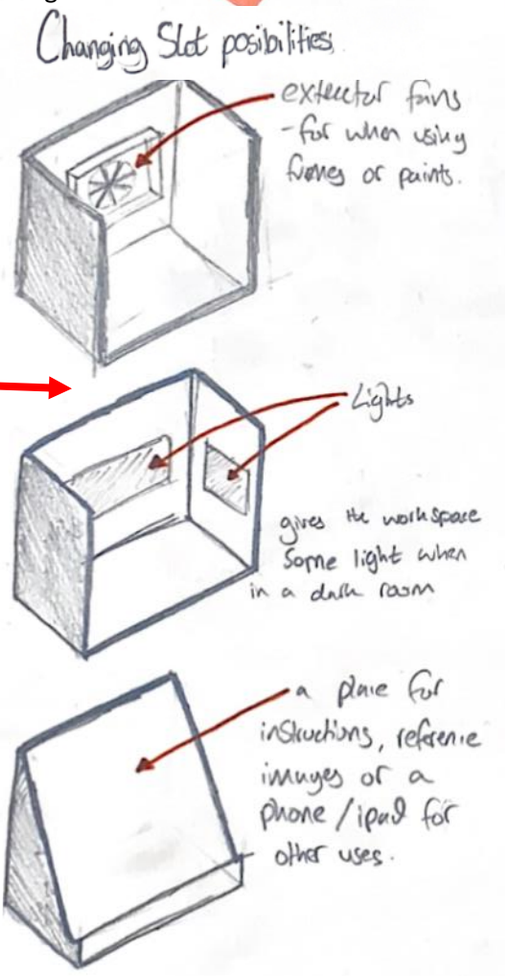
These are different shapes for both the table base and the drawer unit to make the design less boxy and more interesting to look at.







With different hobbies being able to use the storage table, the type of storage can be changed out for something more helpful to the hobby type.

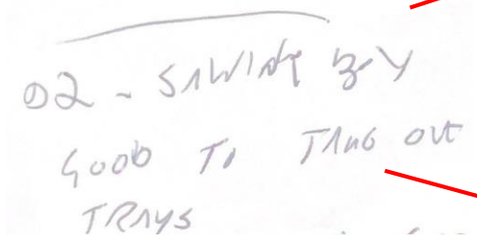


Summary and next steps:

This design is very large and has massive amounts of storage for smaller parts, but could potential be too large, expensive (to manufacture or deliver), and would take too much time to use.

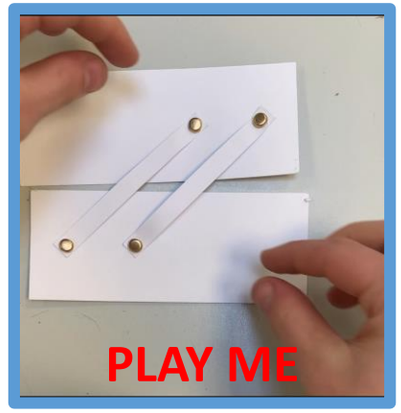
Initial Idea 4

FEEDBACK:



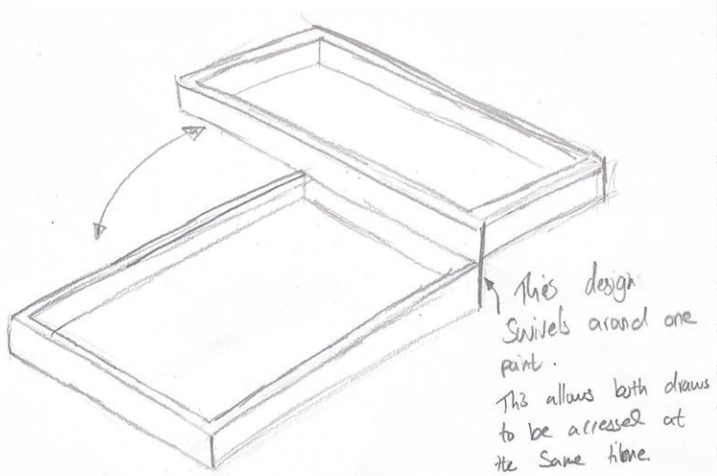
Take out trays are a good idea. Works well to allow the user to take the tray(s) that is needed to where hey are working rather than having to make space for a whole tray to fit.

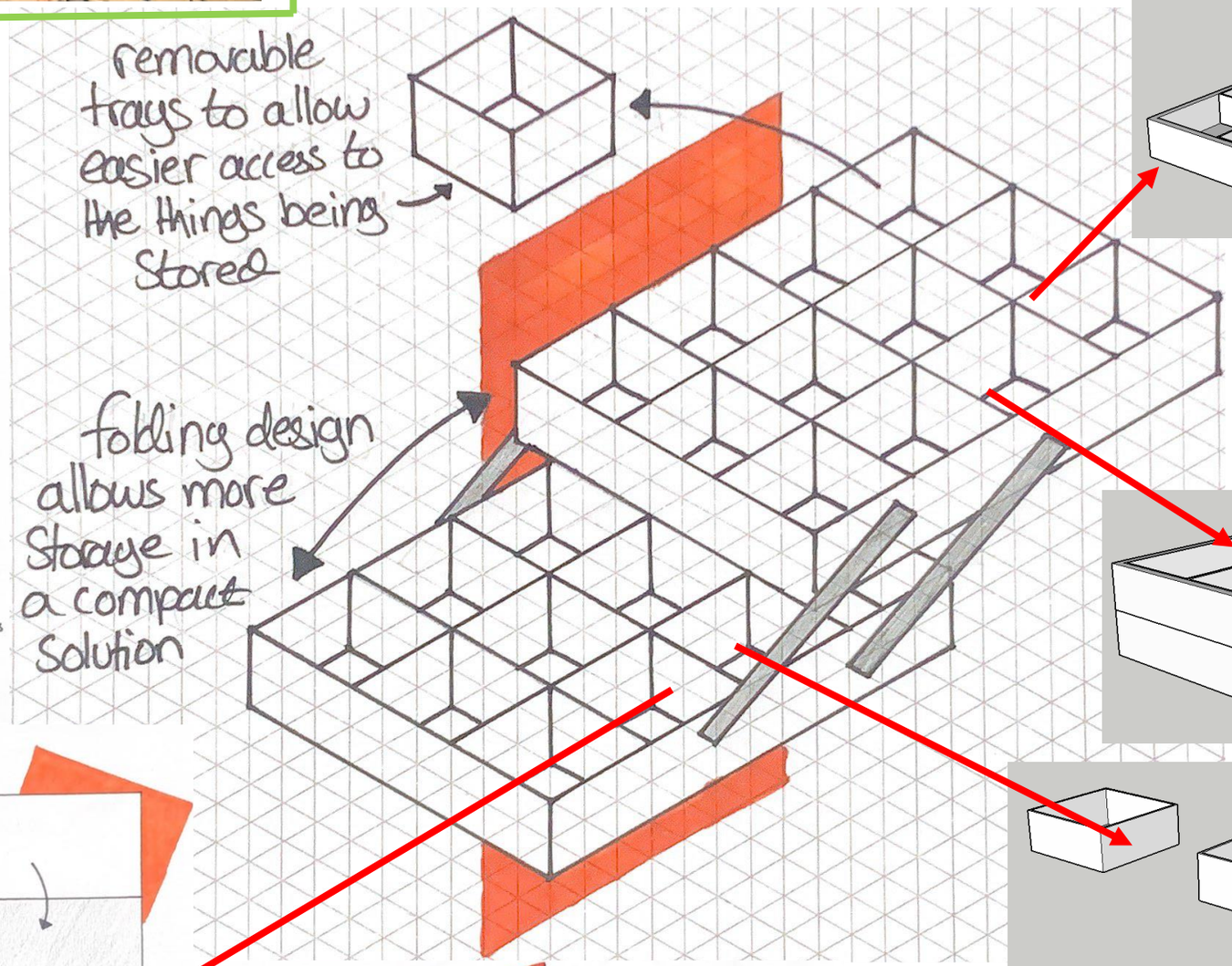
Similar to a sewing box but includes different storage. The trays could be swapped out for something else that would fit in its space.

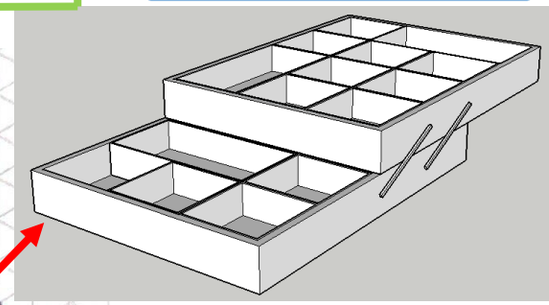


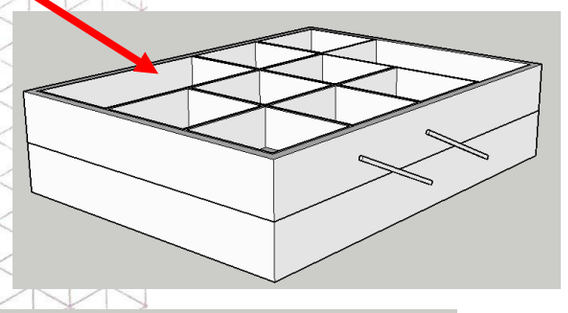
Master list-Response

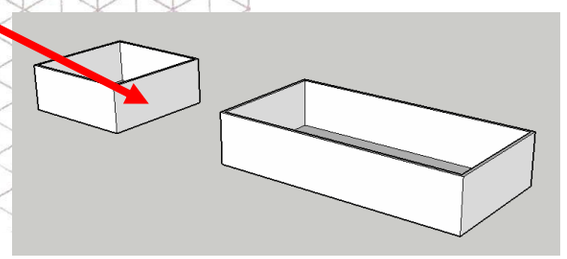
1. Large capacity- with design being desk based it means that there is a large amount of storage at can be easily accessed and used.
2. Lightweight casing- This design in not lightweight and cannot be moved around as it if heavy and fixed to a desk.
3. Lighting- there is lighting around the workspace to allow a better view of what you are doing. More lights could be added around the design in necessary.
4. Portable- the design in not portable and cannot be carried around.
5. Durable- the design should be made durable and if made from a metal frame and a hardwood then the table and drawers will be very durable and strong.

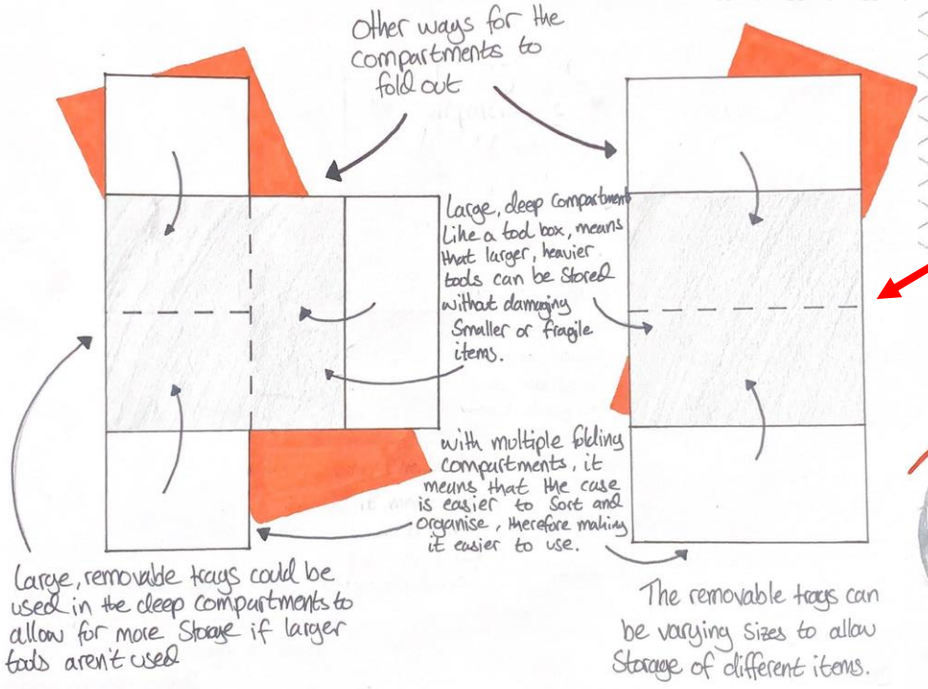


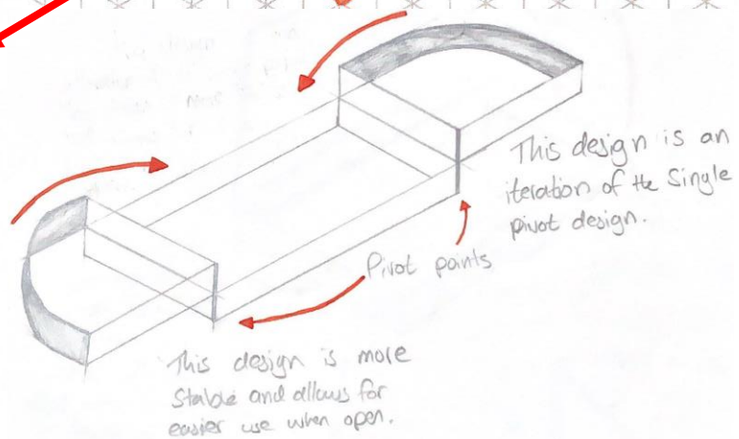












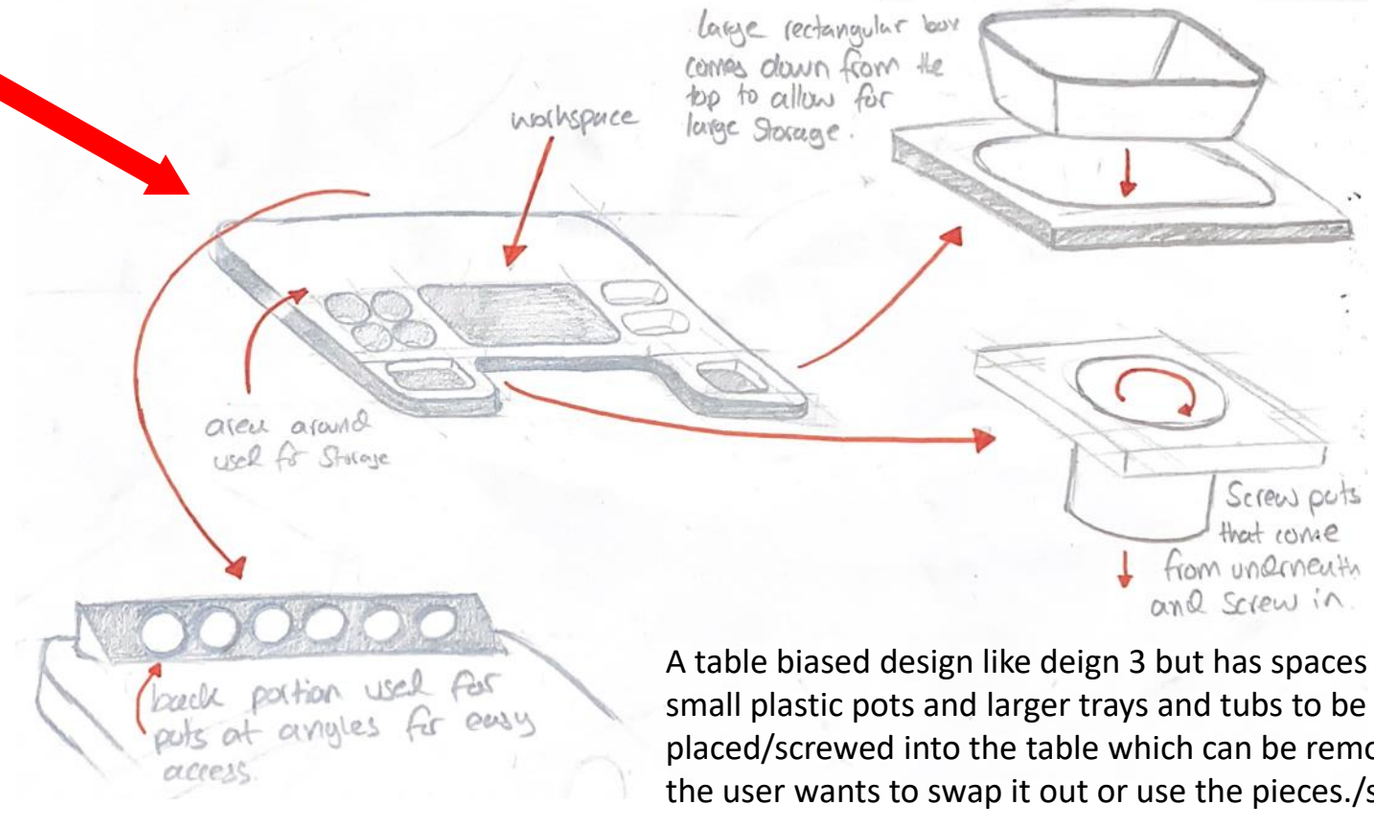
Summary and next steps:

This design works well for lots of smaller parts which many different hobbies have. But the design is complicated and there are relatively similar products that already exist

More research + Initial Idea 5

I had another look online to see what things are available for artists to move their things around in and there are not many options to do so.

The designs are not very versatile and consist of many drawers and large plastics pots which aren't easy to use and are very heavy if needed to be moved around.



A table biased design like deign 3 but has spaces for small plastic pots and larger trays and tubs to be placed/screwed into the table which can be removed if the user wants to swap it out or use the pieces./supplies elsewhere.

I decided to look down a different route, so rather than a drawer with many different things in it uses pots with lids that are stored in shelf type storage which and be removed and the pots can be taken out.

test tube drawer for fridge

The teat tubes are all stored vertically with holes for them to sit in and trays for them to be stored in.

The tubes could be changes with plastic pots/tubs and they could sit in a carrier to be able to move them round easier?

plant propagation table

Involves glass jars/pots being stored in wooden racks or tray so they can be moved round without hassle and then can be taken out and put in different places

fishing tackle

Lots of little plastic pots and containers are stored in boxes or bags which can then be taken out when needed and used in a different place before being put back and carried around. Could work well for modelling or art supplies.

To make a more innovative and easy to use product I can use pots that are already available and make a tray that they can fit into so can be easily carried.

I have changed the design as the original was too broad and I my needs changed to a design that is more portable but has a large storage space, a workspace was not necessary.

Design Brief - Changed

I will design a product which will allow a person with a craft or model biased hobby to be able to carry/move their equipment around easily and efficiently. It will need to be portable and have a large storage capacity.

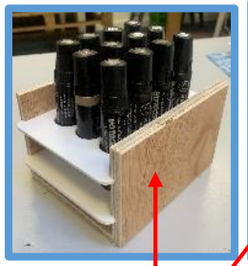
Master list-Response

1. Large capacity- with design being a desk with many different port there is lots of storage which can also be organised into different 'groups'.
2. Lightweight casing- This design in not lightweight and cannot be moved around as it if heavy and fixed to a desk.
3. Lighting- Lighting could be added to the desk via a built-in lamp or added LED lights around the workspace built into the design.
4. Portable- the design in not portable and cannot be carried around.
5. Durable- the design should be made durable and if made from a metal frame and a hardwood then the table will be able to withstand misuse.

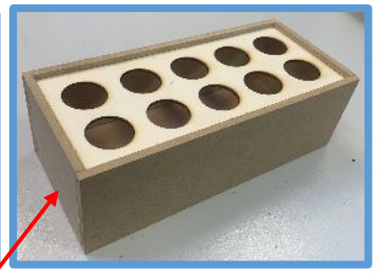
Summary and next steps:

I like the function of this design but it needs to be portable, which I will design next.

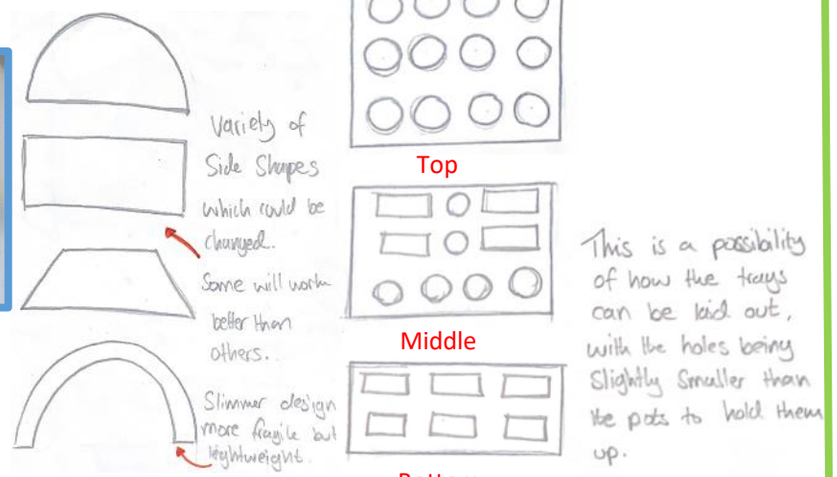
Initial Idea 6

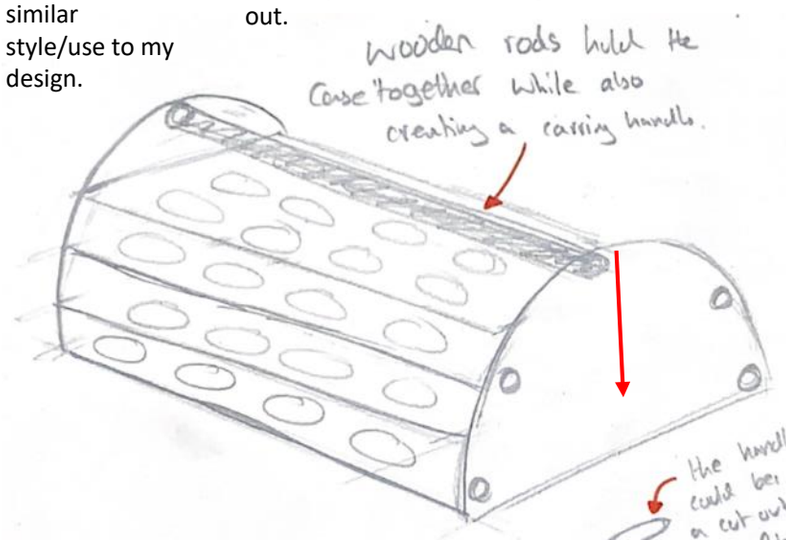


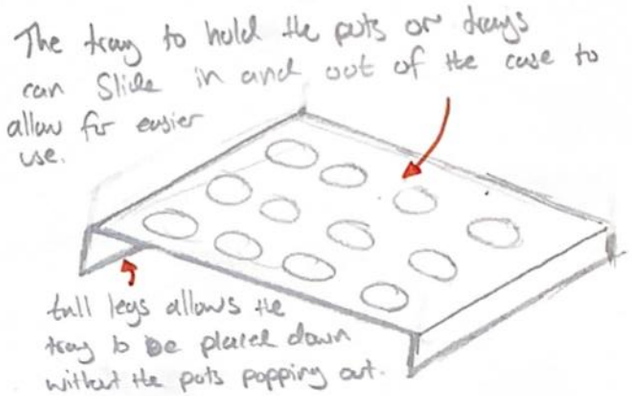
These are some products that I found around my classroom that have a similar style/use to my design.

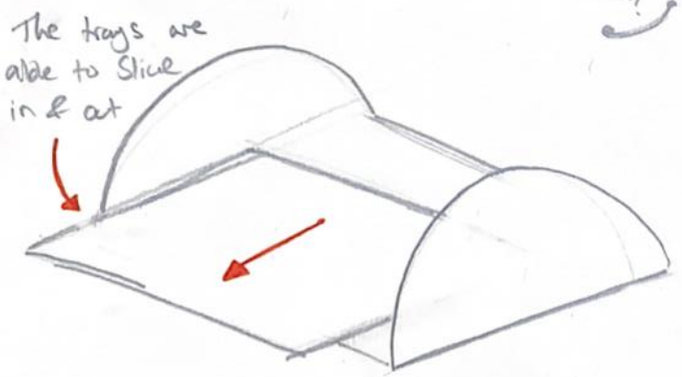


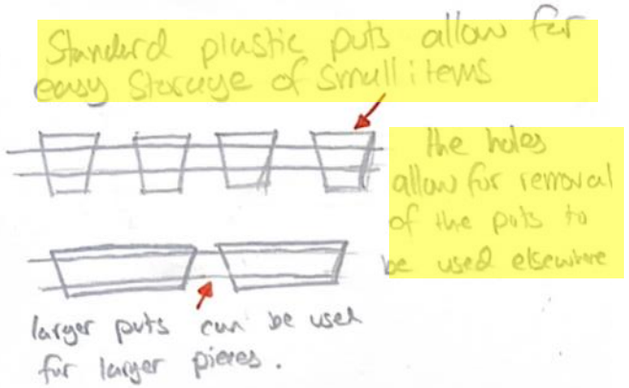
They are similar to my design by using holes in sheets but the items don't sit in them but instead sit through them and stops them form falling out.











Feedback:

I like the idea of a portable carry case for my modelling bits and pieces.
The mix of round pots and rectangular trays/tubs would work well. I wonder if the 'takeaway trays' would be too big?
I use the 500g plastic margarine tubs a lot. They do have a ridge around the top and would fit into a 135mm x 85mm hole (they are 60mm high – see photo).
There are no dimensions on your Ideas Sheet. Roughly how big would it be and how big are the round pots you have in mind?
It will be quite high because even with two trays, you need to accommodate the height of the pots and the tubs.
For practical use I think a rectangular or trapezoid end shape is a better use of the space compared with a rounded/semi-circular end.
The slide-out trays with legs/stand-off edges is a must for easy access to the pots and tubs but would the trays tend to tip downwards when halfway out?
Maybe the trays need to have a lip along the edge which slide into a slot so that the trays stay horizontal. But would that then make the whole caddy unstable if there were two heavy trays half-way out?? Also thinking about that, a grip or ledge to get hold of the edge of the tray easily?
I think I might find a simple shallow tray useful too for loose craft knives, rulers, paintbrushes etc.

The takeaway pots would probably work better

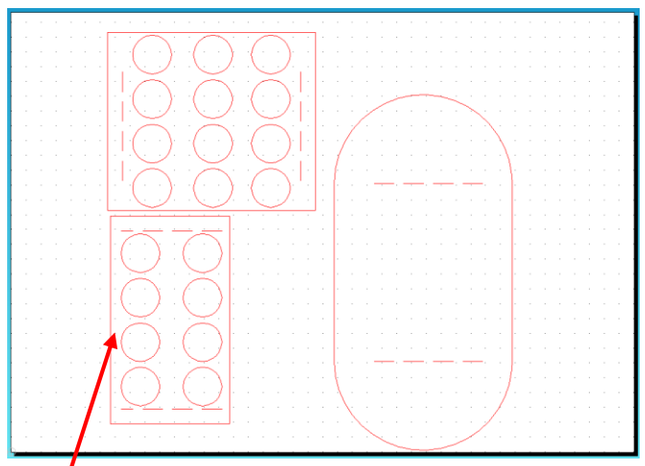
The deeper box would work better and store more items, but the box isn't box isn't clear/see thru so you wouldn't be able to see inside. The plastic tubs aren't quite the correct size to fit brushes or pencils.

I haven't quite decided on the size of the case yet but I will look into the size and do some research on a later development page.

I will look into drawer mechanisms and how well the different styles would work in this design

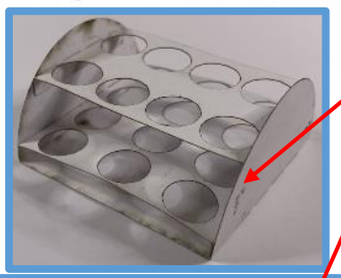
An extra piece of material could be added to the edge of the design to make it easier to pull out.

Here I found some standard plastic ports with lids that will be used in the cutout holes to create easy storage of small parts.



The smaller pot will work well for people who have lots of smaller parts in their hobby. It allows most of the parts to be seen from the outside. Its easy to store a large quantity of the same item.

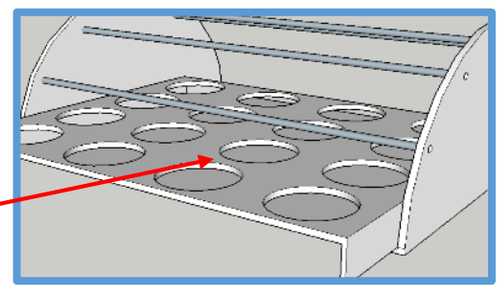
And some larger 'Takeaway' pots can be used to store/move larger parts.



Model of my initial design to see how it could function.

Here is how I laid out the pices on a CA file to be cut on the lasercutter

This is another basic 3D CAD drawing of my design, to show the idea.

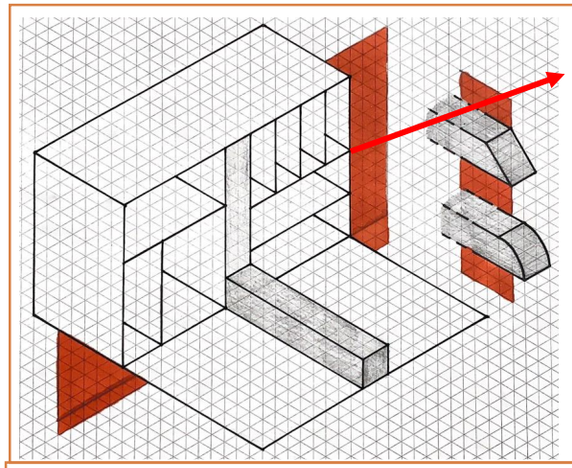


Summary and next steps:

I have come up with 6 initial designs and I have chosen deign 6 (this page) to develop as it is the most innovative design.

Next, I will develop this design in different ways and come up with a final deign that fits the design brief.

Choosing a design



Similar to other products that exist after doing a little more research.

There are some designs out there which have to same function, but achieve it in a different way. Could be made, but possible too similar to other designs.

1

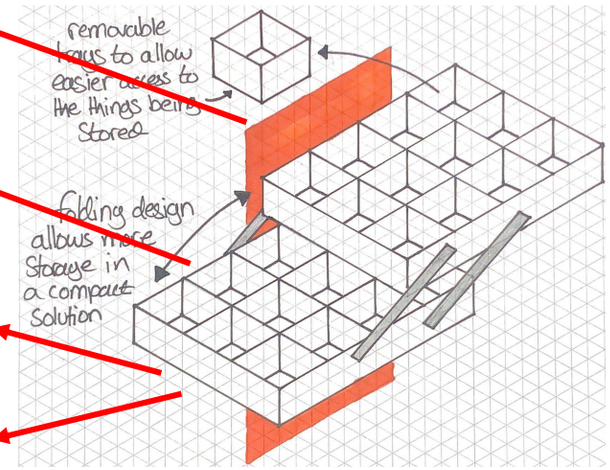
Similar to a toolbox and the fold out design is not as strong and is more likely to get damaged.

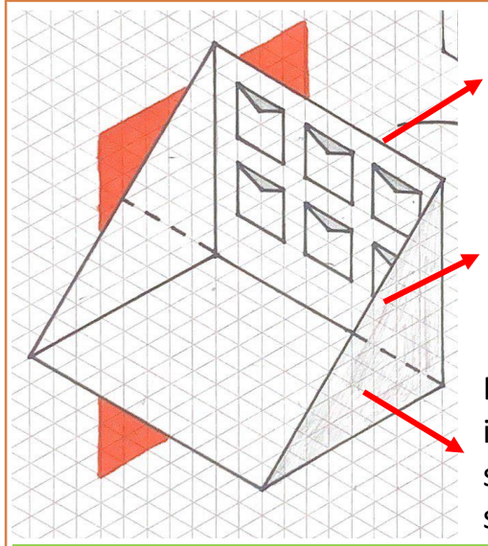
But due to the design it wouldn't be suitable for my brief as it can hold lots of one items but would be insufficient for holding lots of different items in low quantity

The design is very good at compact storage for smaller, high quantity types of items and allows for the items to be taken out and placed where they are working.

Design possible too simple and could be too unsecure/fragile which could made the design weak and unable to be used.

4





Innovative design with the folding mechanism, but is unable to hold thicker tools and materials.

This design is not very suitable, although innovative, due to the lack of 'boxy' storage. This means that it is unable to carry smaller fragile or thicker/bulky parts around

Despite the lack of storage possibilities it does a good job of transporting flat sheets of materials, like card, paper or styrene sheets.

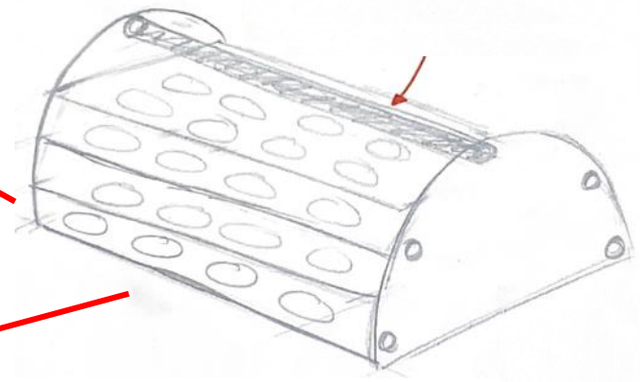
Works well for storing flatter items such as sheets of card or plastic but won't work as well for storing lager, thicker items.

2

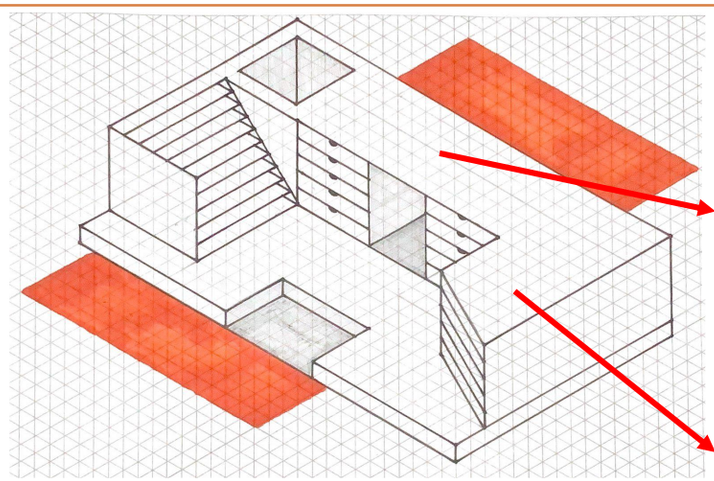
This design includes different parts from the other designs such as removable pots and the sliding trays. The design is not similar to anything which I can find online and therefore an innovative design.

The removable pots allow the tools and products to be spread around to where they are needed and don't have to be kept all together, like in may other products

6



This designs seems to be the most innovative and new design, which also improves on existing products and brings something new to the market



3

The design is not portable and is desk based so does not work as end users wanted a portable design that can be carried around.

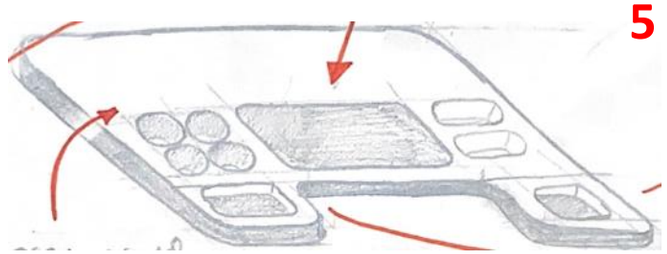
The desk contains all different types of storage for different things and also includes a removable section for specific use. This means that the design is suitable fro m the view of storage but extremely unsuitable from the view of portability and simplicity of use.

There are a few sort of similar products that exist which means to design is very innovative.

A second desk-based design which includes more innovative features like removable trays and pots. But again is not portable so doesn't work with the end user requirements.

This design does not work as it is desk based and is not portable, which is a requirement

5



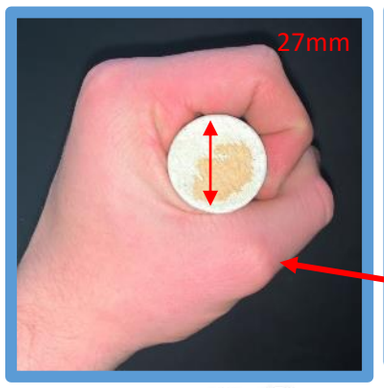
Summary and next steps:

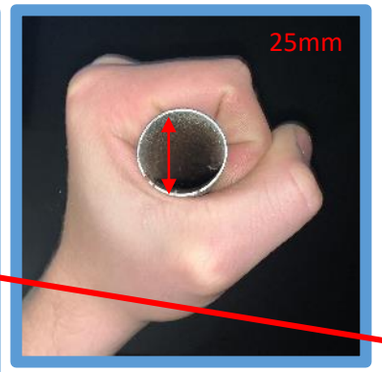
After looking through all the designs and getting feedback for all of them I have decided that design 6 is the best fit for the brief; combining portability, easy of use, lightweight, and innovative features. The design seems to be the best fit out of all the deigns I have come up with.
Next I will look into improving the design and making the design even better suited

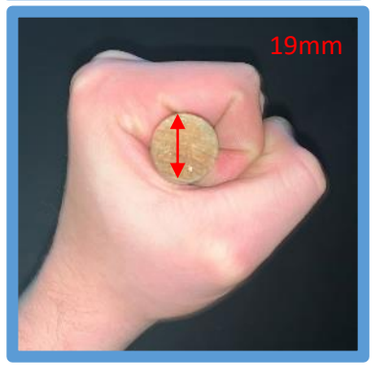
Design development 1

handles

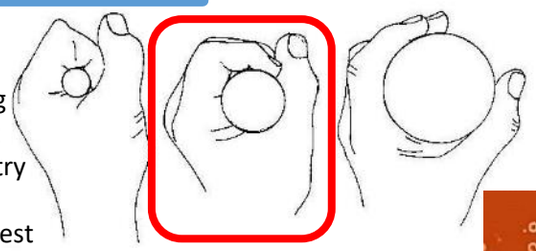
Working out the ideal handle diameter for the most people to be able to use it comfortably is key for the design.

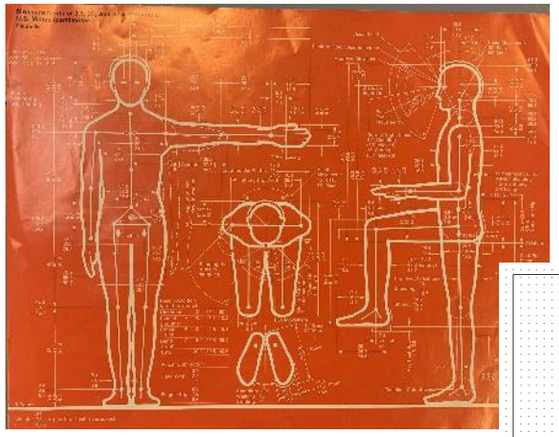


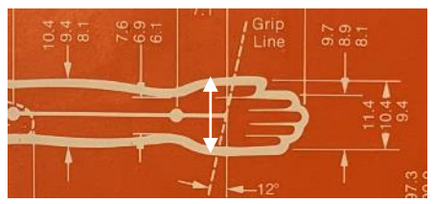


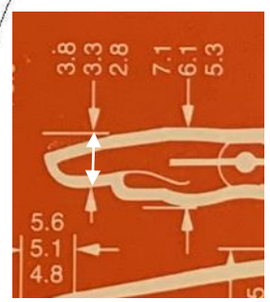


Here I have found some circular tubing with different diameters to try to work out which is the best handle diameter for me.

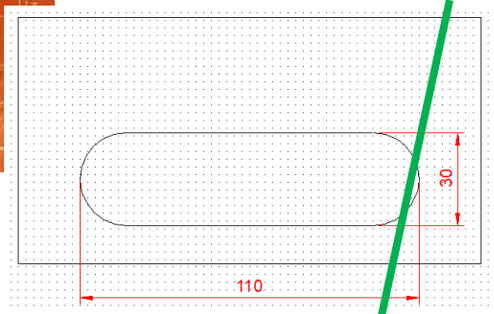






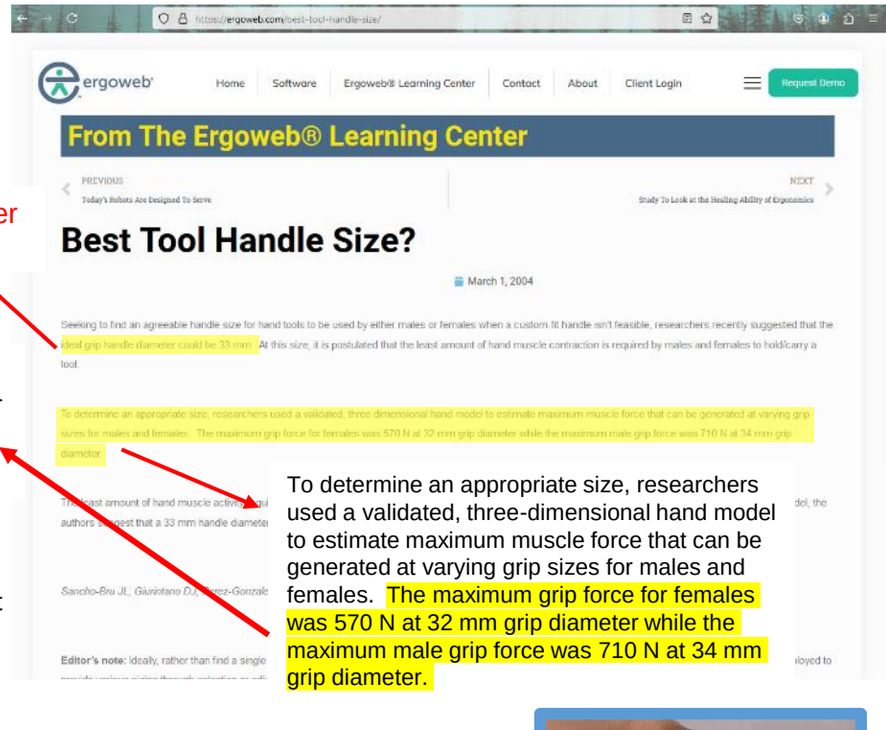


I found an anthropometric data sheet for the U.S male and female, but the measurements for the male is bigger so it will incorporate women as well as men.
For the hand with the 97.5% percentile is 11.4cm (114mm) and for the finger thickness it is 3.8cm (38mm)



After talking to 3 adults and them testing them themselves I need to make the hand hold slightly wider for more hand types to be able to use it, as making it bigger won't change the use for anyone else.

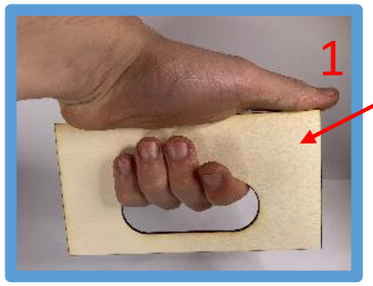
ideal grip handle diameter could be 33mm.



After doing some research online I have found that the most comfortable size for most men and women is around 33mm (34mm for men and 32mm for women)

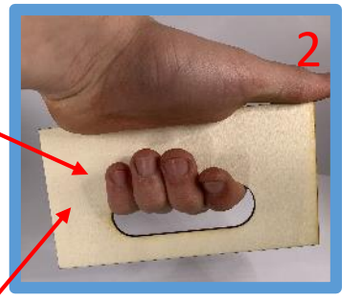
For me the best size of the rods is 27mm, but my hands are slightly smaller than most peoples so a diameter slightly bigger than 27mm (so about 30mm) is a good size.

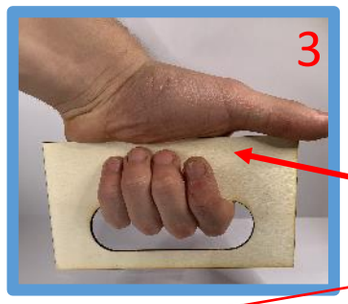
To determine an appropriate size, researchers used a validated, three-dimensional hand model to estimate maximum muscle force that can be generated at varying grip sizes for males and females. The maximum grip force for females was 570 N at 32 mm grip diameter while the maximum male grip force was 710 N at 34 mm grip diameter.



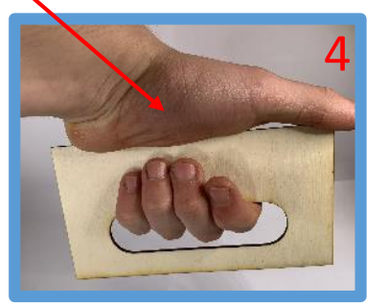
For my hand size designs 1 and 2 are too small in width, so any other people hands wouldn't be able to fit.

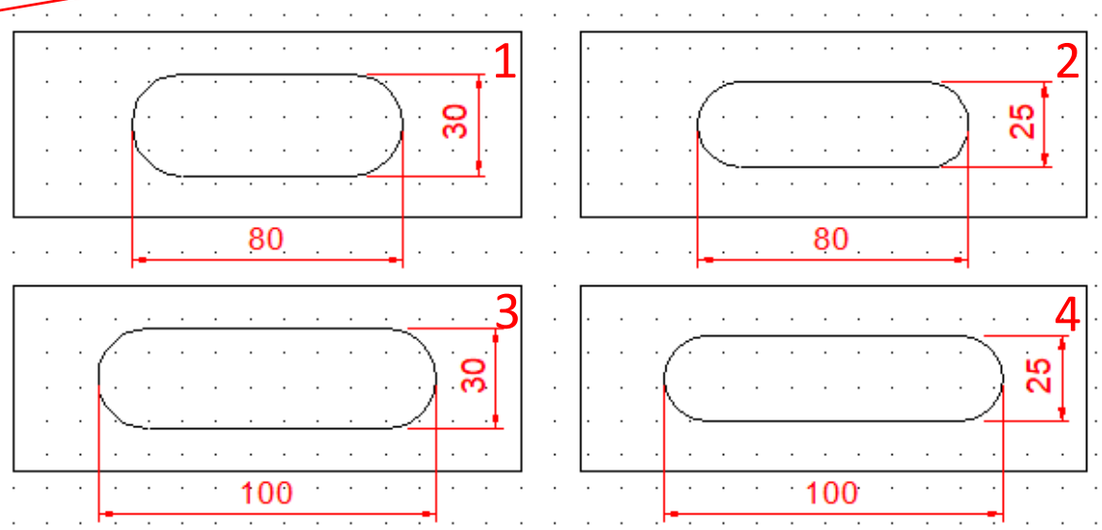
Designs 2 and 4 are the shorter sizes which again don't fit my hand size very well so the taller designs (3 and 1) would work better.





After my testing design 3 works the best for me but people with hand sizes any bigger than mine would struggle. So the cut out needs to be made bigger.





Summary and next steps:

After doing some research into the size and shape of handles I have found that for the rods the diameter should be about 30mm and the size of the side hand holes should be 120mm x 40mm

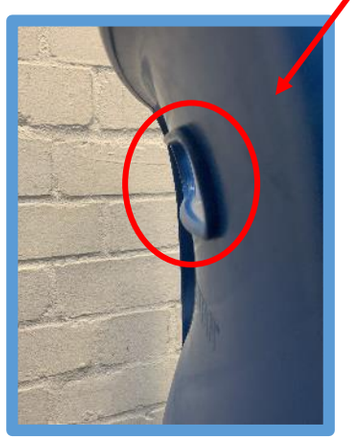
Design development 2

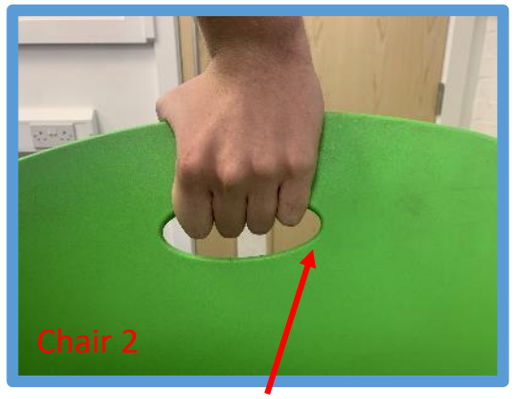
handles 2

I found some products around the classroom which also incorporate the same style handles. All of them are similar-ish sizes.

This chair handle is much bigger than my sizes I came up with, it is almost too big to be used easily with most people's hands being able to move side to side when grabbing it.

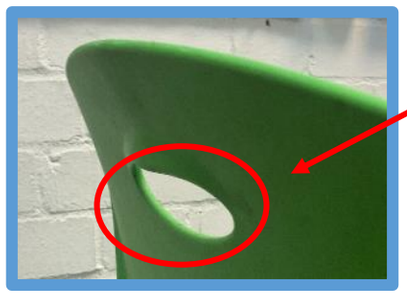
This design for handle includes an extra piece of curved plastic which allows the handle sit better in people's hands, which makes it more comfortable to be able to carry heavy loads.

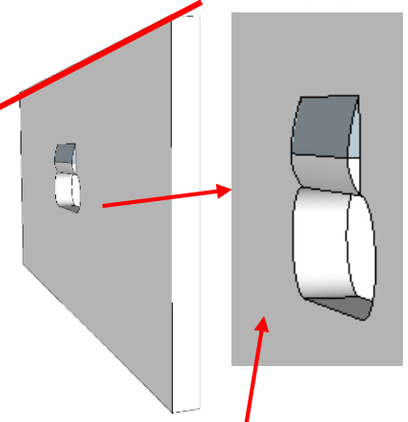




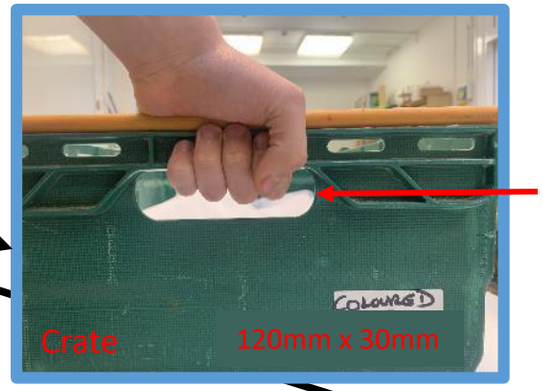
This handle design is similar as the size is similar to my research but the shape of the hole is slightly different with it being more curves at the sides. This isn't an issue as the pinkie and index fingers are smaller than the other fingers so don't take up as much space.

The handle design also includes an extra piece of plastic to make the grip more comfortable when carrying.



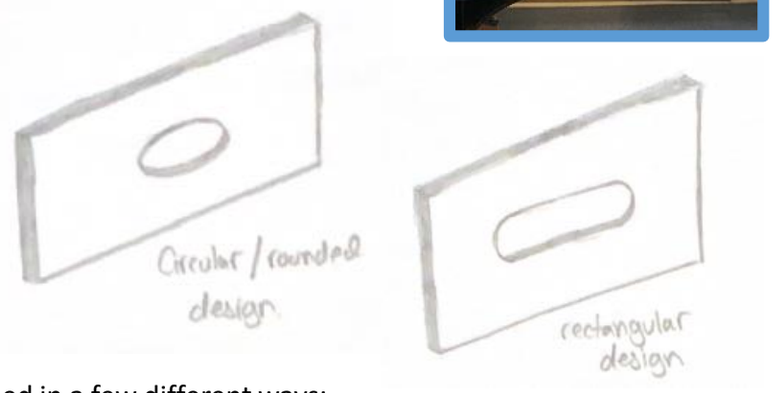


When I add the extra material to my design when making it I will most likely glue a small piece of wood to above the hole and use a hand file to form the correct shape, but if it were to be made commercially it would need to designed to a shape the suit the majority of people and then cut out the shape and glue it on or it could be milled on the design when the end shape it being cut.



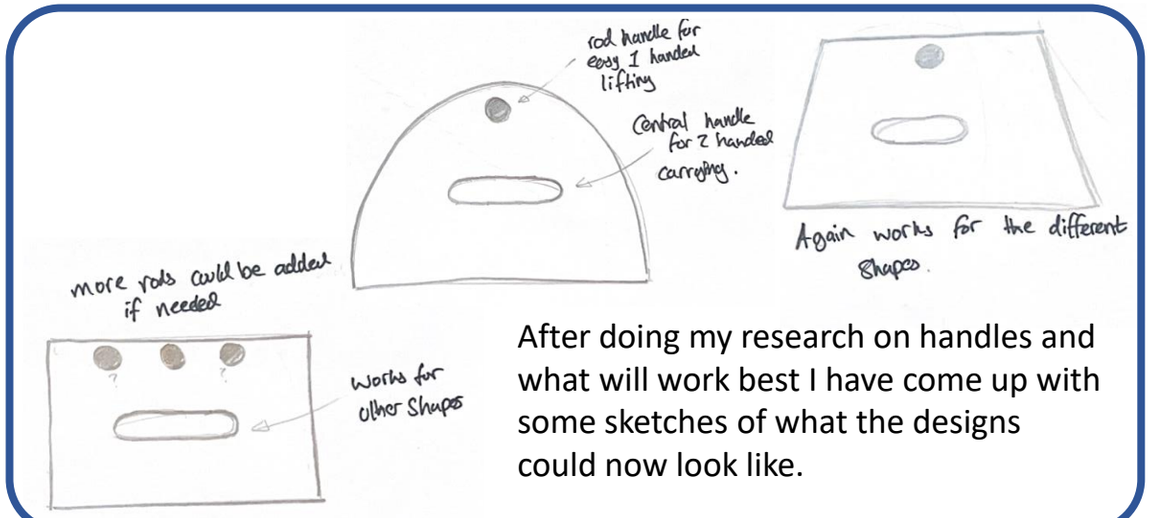
The handle size on the crate is very similar to my initial idea of the size of the handle. It again uses extra material to create a more comfortable hand hold, but only adds material to the top side where someone is handling the product and does not need more material to the underside.

Another chair design with doesn't have a handhold in the normal style but again adds material to the topside of the hold to make it more comfortable and ergonomic.



The added material could be added in a few different ways:

1. A small amount to the top side to make the hand hold more comfortable
2. More material added above to also support the hand as well as making a more comfortable grip
3. Material added to both the top and bottom (probably not necessary as the bottom grip wont be used.



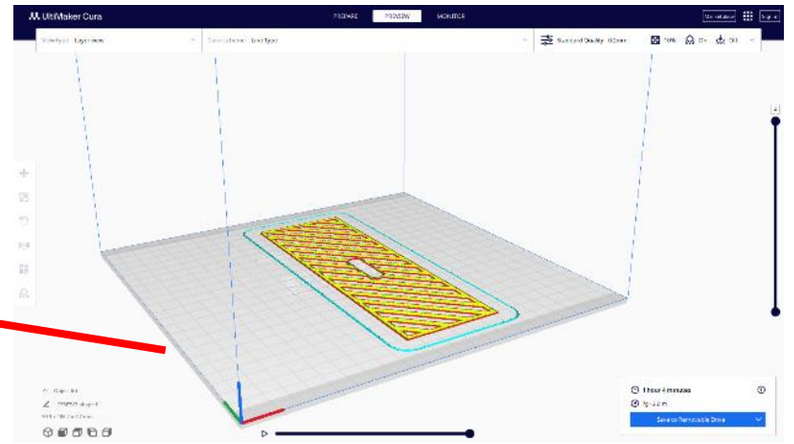
After doing my research on handles and what will work best I have come up with some sketches of what the designs could now look like.

Summary and next steps:

After looking at different styles of handles and different products I have decided that the style of the handle will be more rectangular with curved off corners with some added material to make the grip/hold more comfortable.

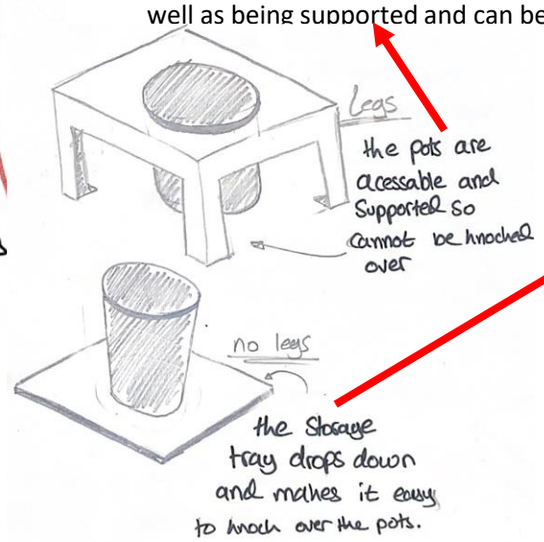
Design development 3

trays

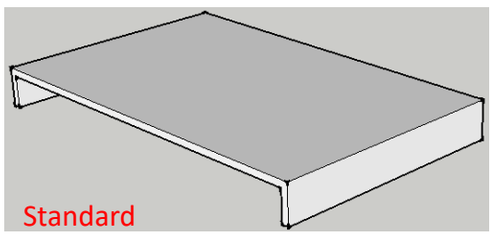


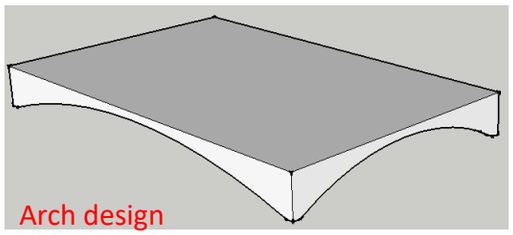
I used a 3d cad software and a slicer the crate a 3d file and then a 3d printed demo of one of the lightweight designs

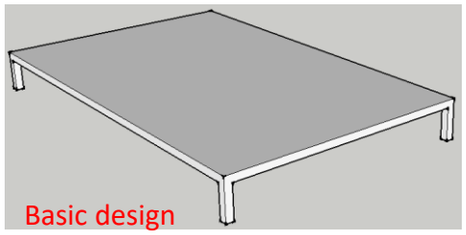
There are legs on the trays to avoid/stop the pots popping up when the tray is placed down, so they stay in their hole as well as being supported and can be taken out if needed.

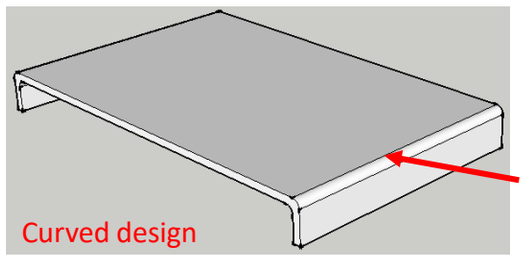


PLAY ME


Standard design

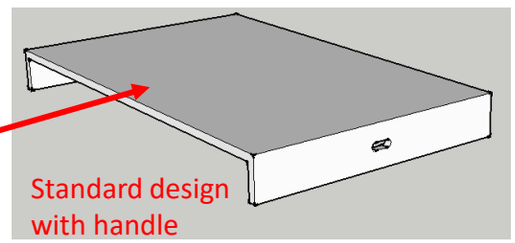

Arch design

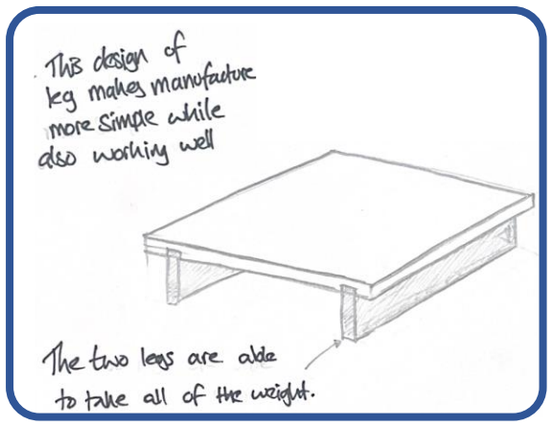

Basic design


Curved design

Here are some CAD drawings of some ideas of the different legs I came up with.

Personally I think the curved design combined with the handles would work well and would make it easier to make the tray around.


Standard design with handle

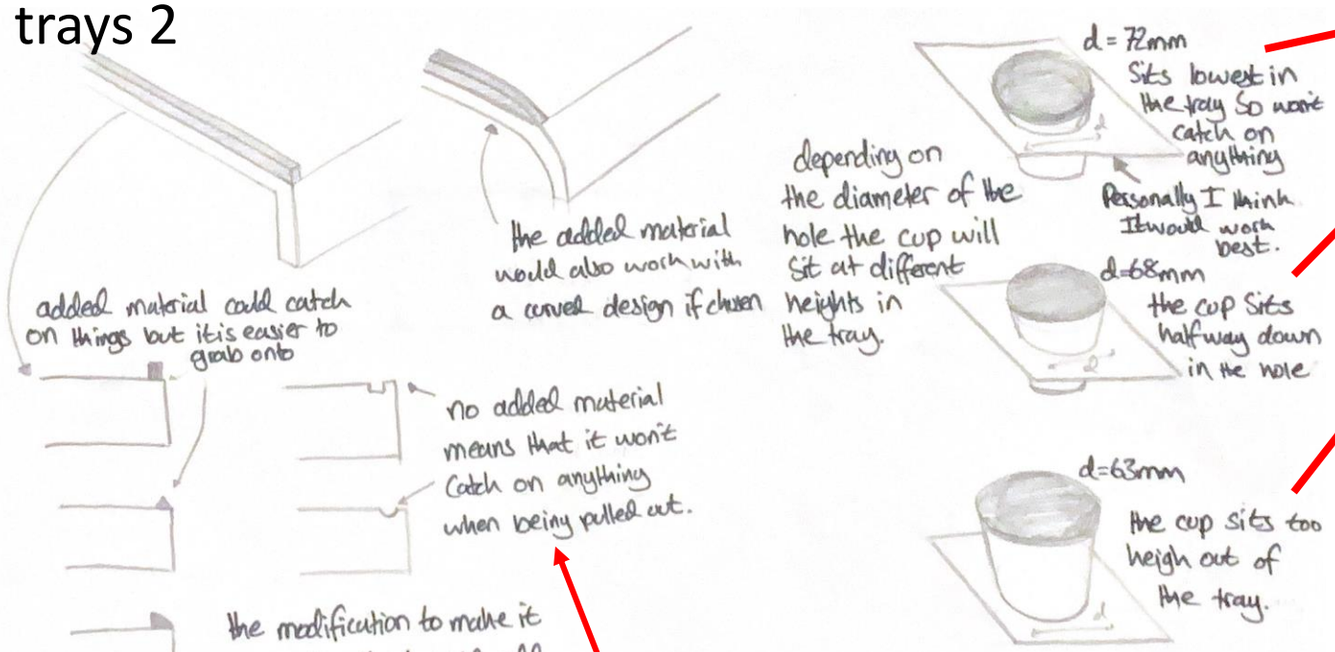


Summary and next steps:

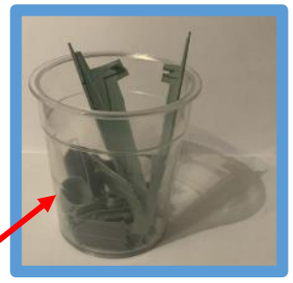
On my next page I will carry on with the development of the trays by responding to some feedback and looking into the tray 'mechanism'.

Design development 4

trays 2



The pot is sectioned up into 3 sections which all have different diameters so depending on where the cup is going to sit he hole needs to be the right size to fit it.



Here I have put some of my small parts in the pot to see if it would work well as an idea for my hobby, which it does other then for the larger parts which could be put in the trays instead.

I already use plastic 'takeaway' boxes to store paints in but I also use ice-cream tubs to store loose parts in which are similar to the margarine tubs as suggested but the margarine tubs are slightly smaller and have an easier shape to cut out and it in

After a visit to hobby craft I found some basic pots which come in a variety of sizes and can hold lots of small pieces or a few larger parts/tools in.

They are also lightweight, although not see-through which could be reason not to use them

Feedback:

I like the idea of a portable carry case for my modelling bits and pieces.
The mix of round pots and rectangular trays/tubs would work well. I wonder if the 'takeaway trays' would be too big?
I use the 500g plastic margarine tubs a lot. They do have a ridge around the top and would fit into a 135mm x 85mm hole (they are 60mm high – see photo).
There are no dimensions on your Ideas Sheet. Roughly how big would it be and how big are the round pots you have in mind?
It will be quite high because even with two trays, you need to accommodate the height of the pots and the tubs.
For practical use I think a rectangular or trapezoid end shape is a better use of the space compared with a rounded/semi-circular end.
The slide-out trays with legs/stand-off edges is a must for easy access to the pots and tubs but would the trays tend to tip downwards when halfway out?
Maybe the trays need to have a lip along the edge which slide into a slot so that the trays stay horizontal. But would that then make the whole caddy unstable if there were two heavy trays half-way out?? Also thinking about that, a grip or ledge to get hold of the edge of the tray easily?
I think I might find a simple shallow tray useful too for loose craft knives, rulers, paintbrushes etc.

The takeaway pots would probably work better

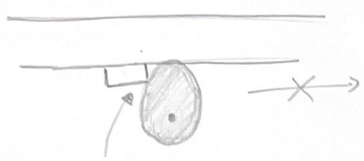
The deeper box would work better and store more items, but the box isn't box isn't clear/see thru so you wouldn't be able to see inside. The plastic tubs aren't quite the correct size to fit brushes or pencils.

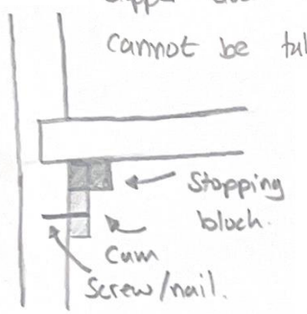
I haven't quite decided on the size of the case yet but I will look into the size and do some research on a later development page.

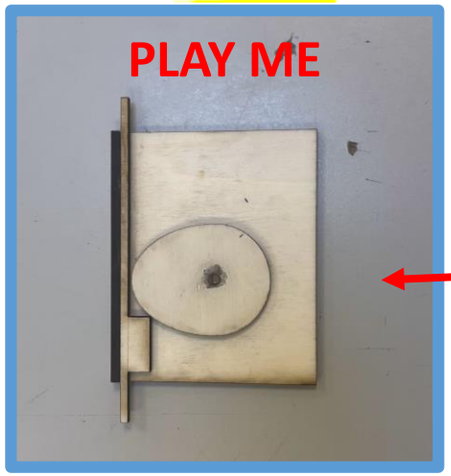
I will look into drawer mechanisms and how well the different styles would work in this design

An extra piece of material could be added to the edge of the design to make it easier to pull out.

Locking mechanisms - Cams







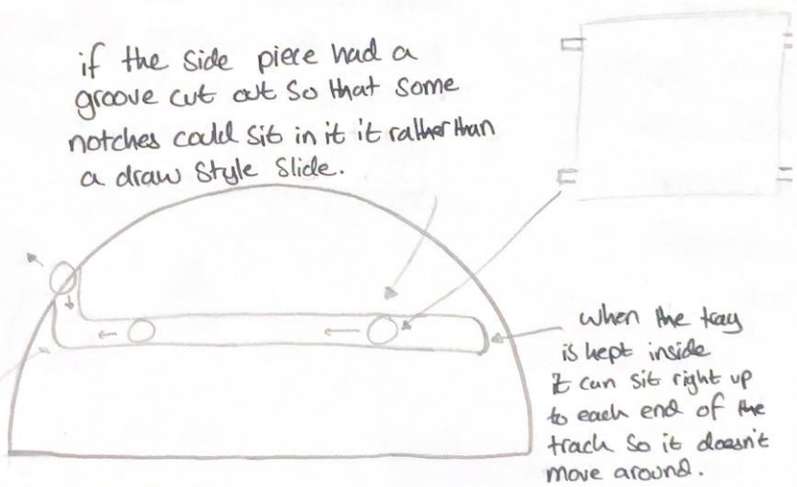
This video shows the concept of the locking cam. When the cam is up the tray cannot come out but when rotated it is free to move.

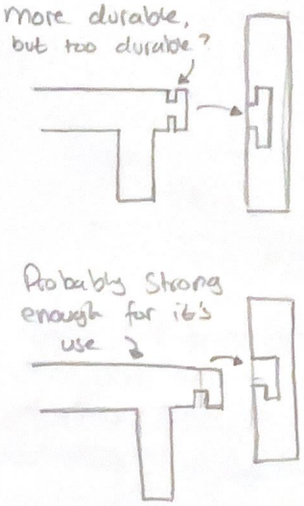
Summary and next steps:

Here I have found a few issues and have come up with a few different possibilities on how to fix/prevent the issues.
I have also designed a mechanism to allow the trays to be locked in place to stop them sliding out, which can be added to the final design.

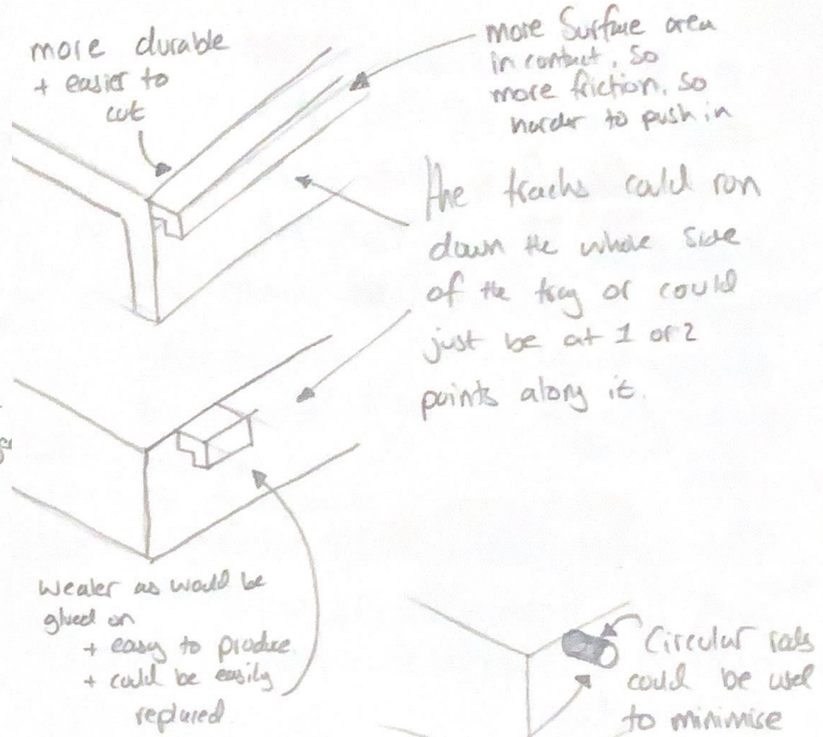
Design development 5

Trays 3

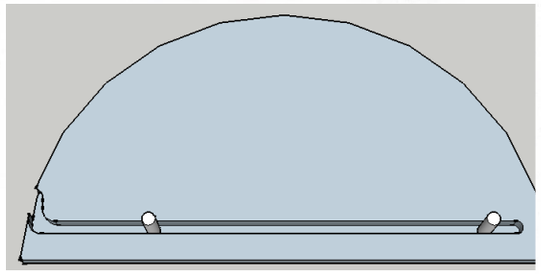


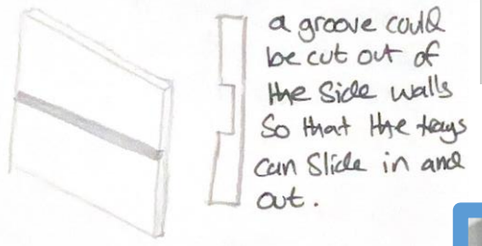


The groove the trays slide into could be different shapes as some are more durable/strong than others.

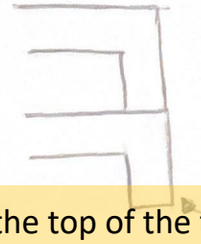


The rightangle means that when the tray is placed inside it cannot be tipped out, but can be easily lifted up and out when it needs to be removed.

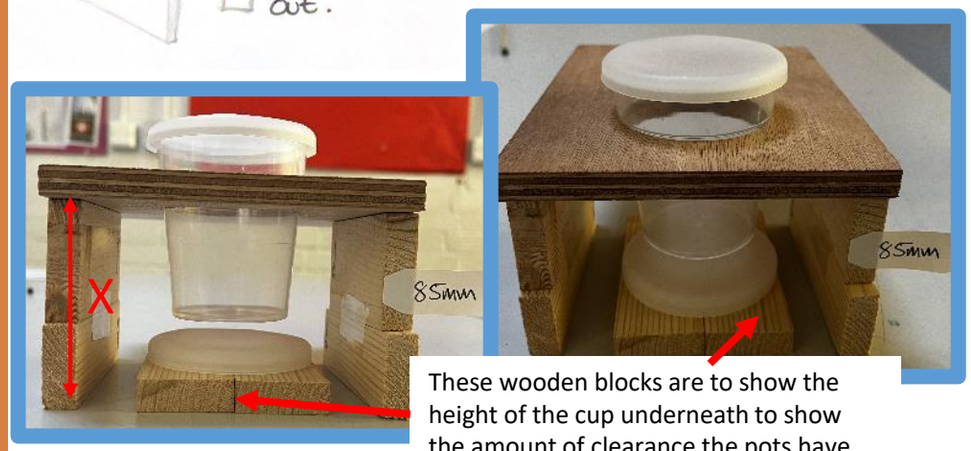




The trays could just stack up in the container but would then be loose and would need to be fixed in place somehow



"If the top of the two trays is going to slide out then does the bottom one need to."



These wooden blocks are to show the height of the cup underneath to show the amount of clearance the pots have

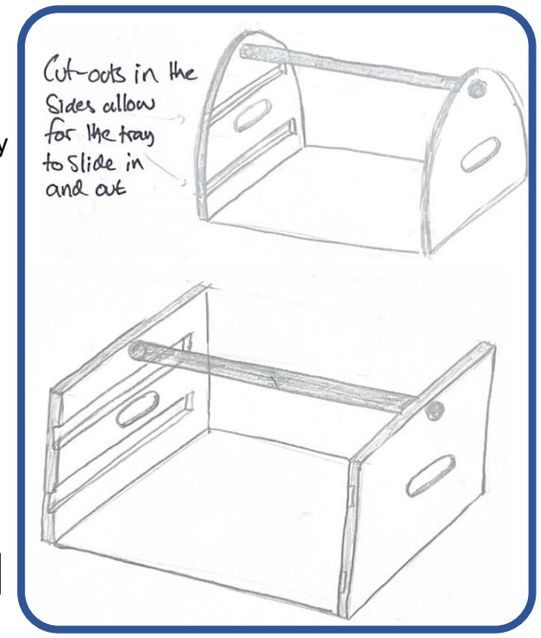
The reason the trays are able to slide is to allow them to be accessed. So if the top tray comes out then the bottom one doesn't need to be removed as it can then be accessed within the frame.

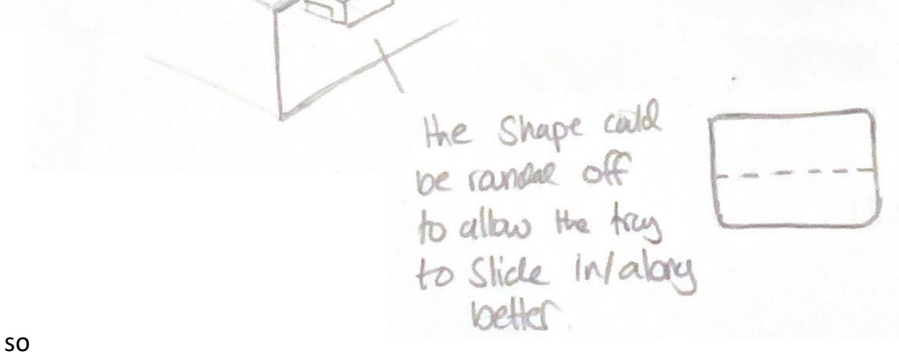
A more simple design would allow for the weight to be reduced, so it would be easier to carry/move around, as well as allowing for items/bits to be stored before it gets too heavy to move.

I have used wooden blocks to create a height of 85mm to see how much space between the cups would be created. I think that if that the gap between the two trays (X) was 88mm instead of 85mm, it would allow for mare space if the cups are filled with heavy things and made the tray bend a bit.

There needs to be a gap between the two trays to allow for some bending. When the trays are fully loaded they will sag a bit in the middle so some extra space should be given to allow them to be still removed.

This means that the design can become more simple, with only one sliding piece, which can reduce the cost of the final product as well as improving the strength and stability of the case.





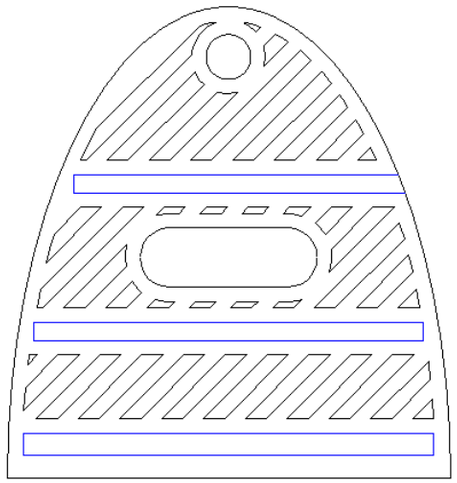
Summary and next steps:

Here I have decided what the design of the trays will be like. Next I look into and decide what shape the end pieces will be.

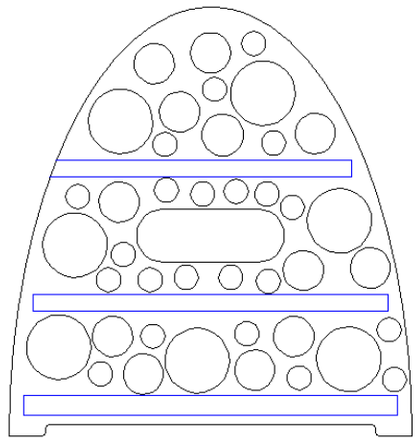
Design development 6

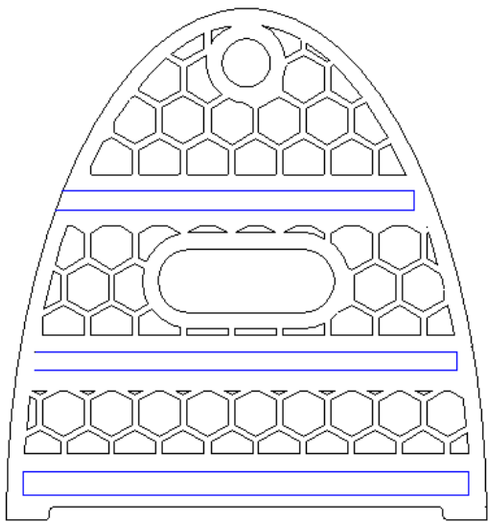
Side designs

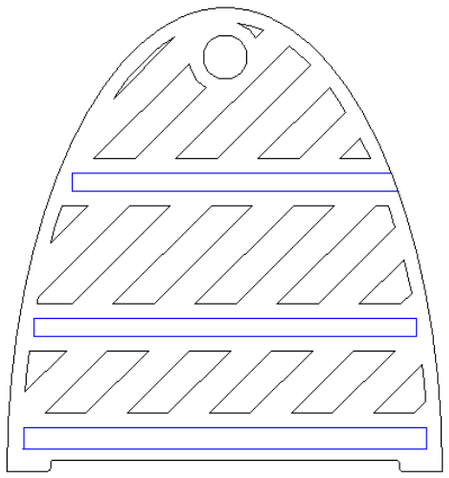
Personally, I think that the curved end shape is the best as it gives the case a personality and style, making it look more innovative. But it also maximises the space efficiency without the case being a box.



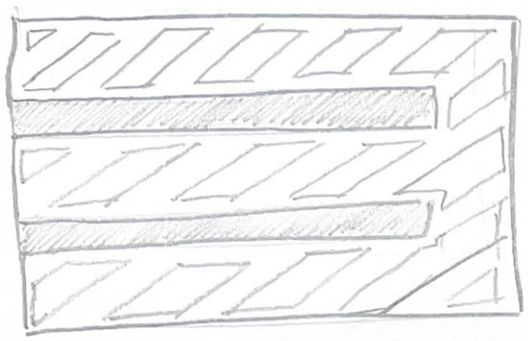
I have added some slits/holes into the design. This reduces the weight of the case without compromising the strength or sturdiness. It also improves the aesthetics of the case.



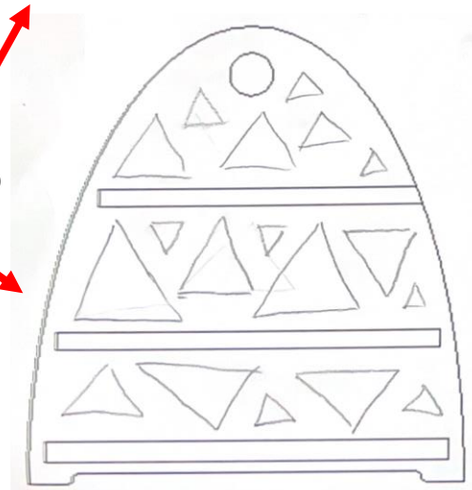




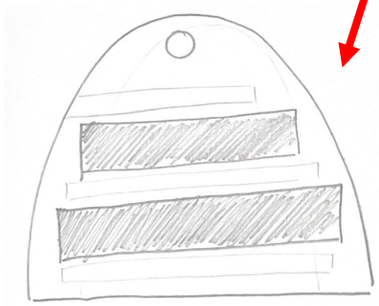
I have come up with a few different side designs with different shapes being used to cut down the weight.



works with different shapes.

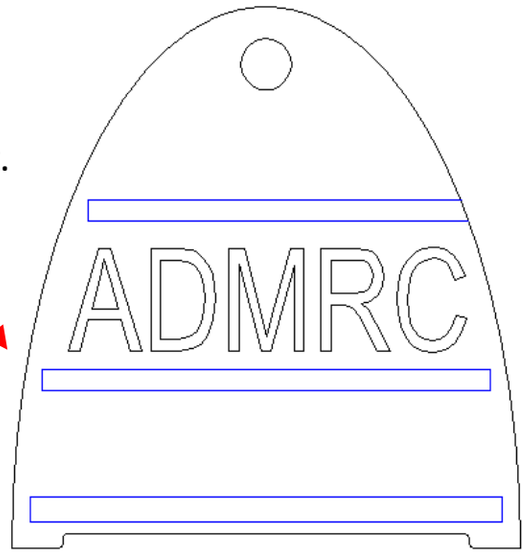


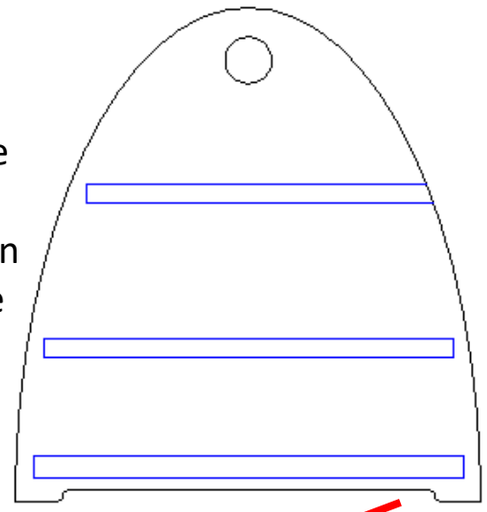
Personalisation could also be a possibility with 1 or 2 areas that could be styled. It could be filled with name, club name, hobby, or what equipment.



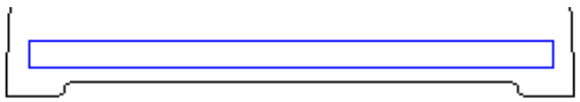
Spare for engravings like logos (if a company bought it) or names / images to customise it.

An example if my stakeholder ADMRC were to buy some.





I have added a cut-out to create some ‘feet’ on the design. This allows it to be more stable when placed down and allows it to be placed on bumpy/uneven surfaces.

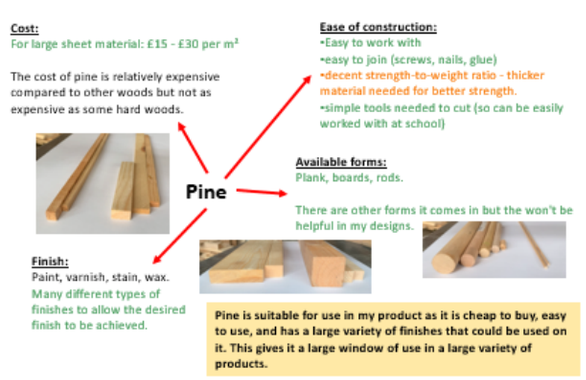


Summary and next steps:

Here I have decided to go for the rounded end shape as it looks the best without reducing the functionality. I now need to decide what material will be best to make it from.

Design development 7

Materials/methods of manufacture



Stability:

MDF is more stable than pine due to its construction. Wood fibres are glued together which creates a more consistent material with little variation.

It also means that the material is more resistant to bending with more weight.

Warping:

Due to its consistent construction, it is less prone to warping making it more effective in a wider range of humilities compared to the natural structure of pines fibres

Now that I have my final design, I think that MDF is a more suitable material than pine, here are some reasons why:

Cost effective:

MDF is much more cost effective than pine as it is made from wood fibres and a resin. This means it can use waste from industry (less raw materials are used) making it cheaper to manufacture/produce.

Strength:

MDF is stronger than pine due to its engineered construction and consistent density. The material has a consistent strength throughout the whole board due to the lack of grain pattern.

Larger sheets:

MDF is available in larger sheets of material as it not limited by the size of tree growth. It is a manufactured board meaning it can come in much larger sizes making it more efficient in large scale production.

Ease of machining:

Due to its uniform construction, it is much easier to work with. CNC machining will be much easier with a lack of grain as the material won't tear or splinter when cut.

Mild steel:

Mild steel is no longer viable to use in my product due to the products complexity, requirements and aesthetics. The side designs will be too complex to make from mild steel as it is harder to mill and shape. One of my requirements is that the case needs to be lightweight, while mild steel is a lightweight metal, MDF or any softwood will be more effective as they have a better strength-to-weight ratio. The aesthetics of bare mild steel is worse than that of MDF. This would mean that an extra potential step of a finish (like powder coat or galvanising) will be needed to make it look better, increasing the cost of manufacture.

Methods of manufacture (of MDF):

The easiest way to manufacture MDF on an industrial scale is to use a CNC router, which can be programmed to cut out extremely accurate shapes.

CNC routers have large cutting beds which allow for a large number of pieces to be cut at once, improving the efficiency of the process.

The shapes can be tessellated on the sheet of material again increasing the number of parts which can be cut.

Smaller scale manufacture:

MDF can be easily worked on with hand tools such as jig-saws, routers or hand saws.
Due to the resin used in the material positive extraction is needed when working with it.

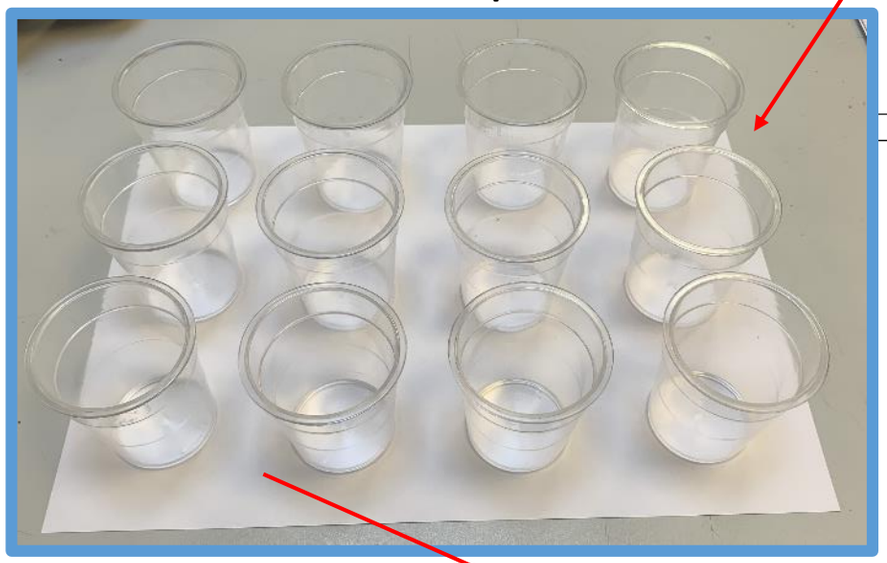
It is an ideal to use because of how easy it is to work with. This makes it ideal to use in my product as I can use it at school with the equipment available to me.

Summary and next steps:

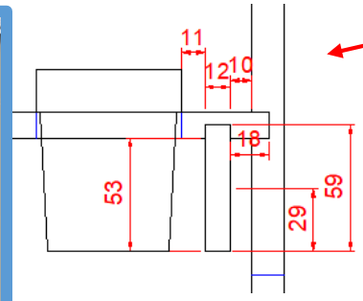
I have looked into the different types of materials that could work for my design and I have decided to go with MDF for my prototypes it is easy to work with and cheaper.
The final product will also be made from MDF due to all of its benefits when being worked on in a larger scale manufacture.

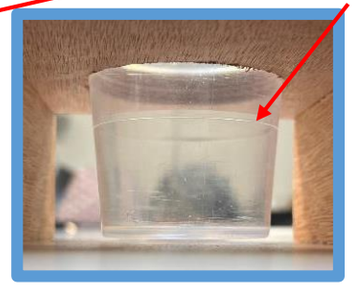
Design development 8

Size and other compartments

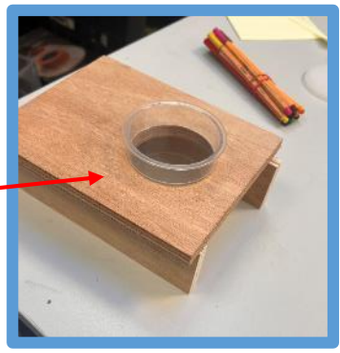


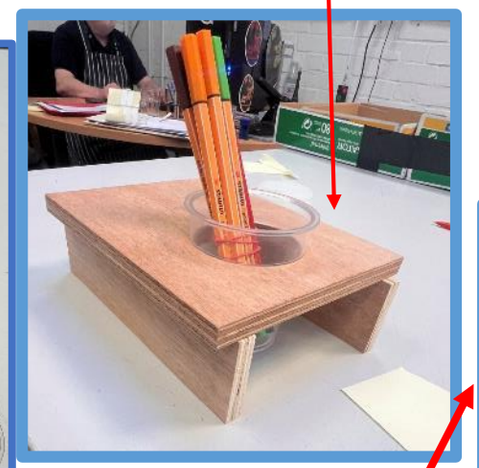
On an A3 sheet of paper I can fit 12 pots. So if I made both of my trays a size of A3 and have 2 trays then I can fit a maximum of 24 pots in the case, unless I swapped some out for the margarine or takeaway pots.

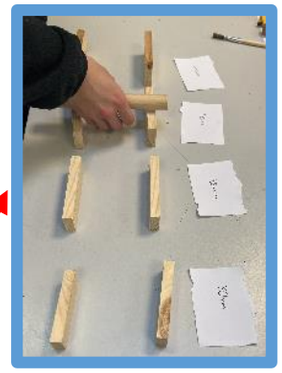


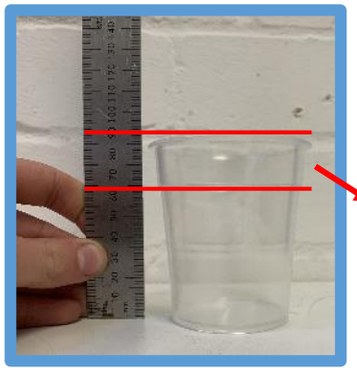


I saw a potential issue with my measurements and technical drawings. The height of the legs are at the same height as the bottom of the cup. This means that when they are placed down the cup will sit up out of the slot. To test this I cut a circle out and some pieces of wood which are the same height. This allowed me to see that there was a 1-2mm clearance due to the CAD drawing of the cup. Also with the tray being 12mm thick it is unlikely to bow under the weight pout into it so the leg heights are alright



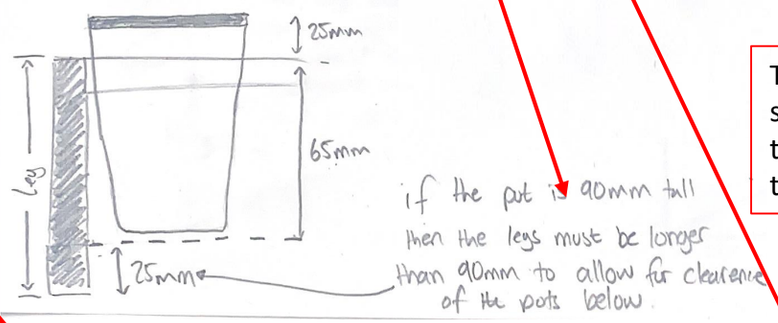


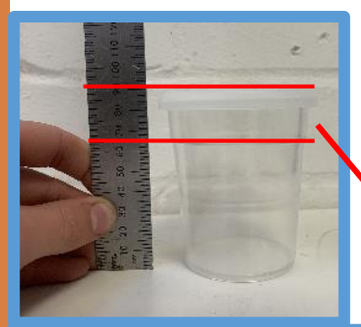




The footprint of the design will be about 297mm x 420mm or A3 size.

Without a lid the pots are 87mm tall and the ridge that I am planning on having my pots sit on are 65mm tall.



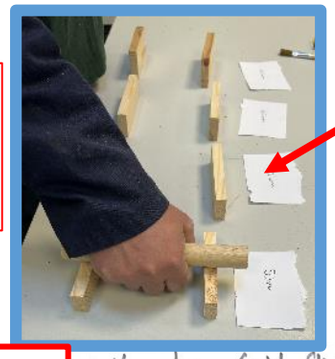


With a lid the pots are 90mm tall and the ridge is the same height

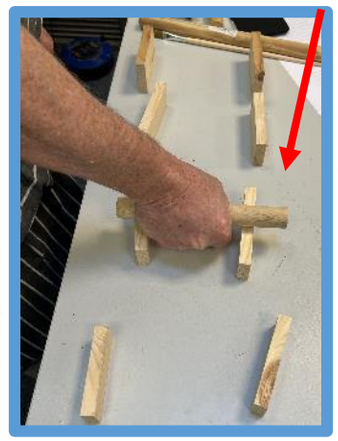
Here I have cut some wood to the rough size that I need the trays to be to see if the size works for both trays.

There also needs to be space to allow for the tray to slide underneath the handle.

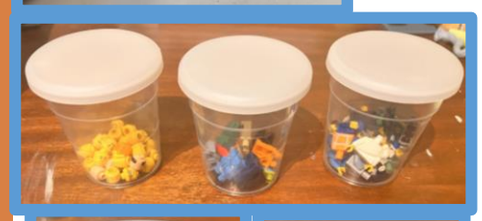
If the design is made with 2 shelves then the height of the design will be 90mm + 90mm, so 180mm tall but with an added shelf/tray underneath for flat sheets the height could go up to 220mm.



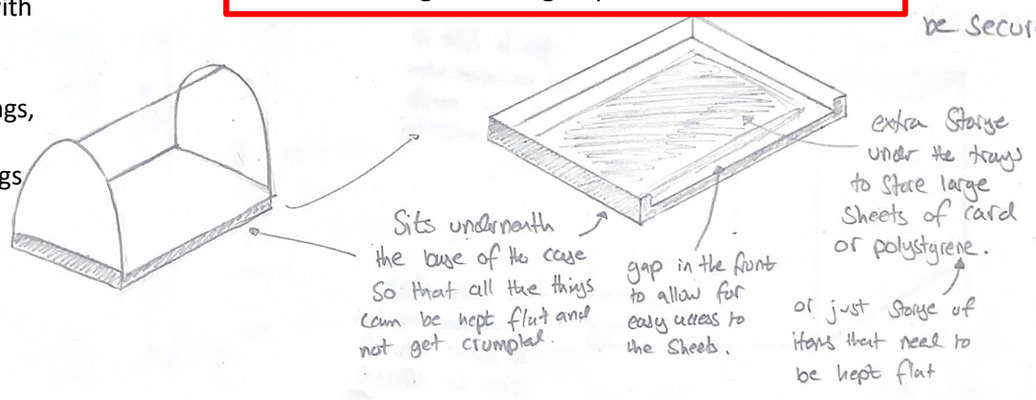
I used some classmates to see what height from the pots the handle should be. From 6 people one said 30mm one said 50mm but most people preferred the 40mm height.



This height would allow for 95% of people to use it comfortably and people with smaller hands can still use it. It just restricts the small amount of people with very large hands.



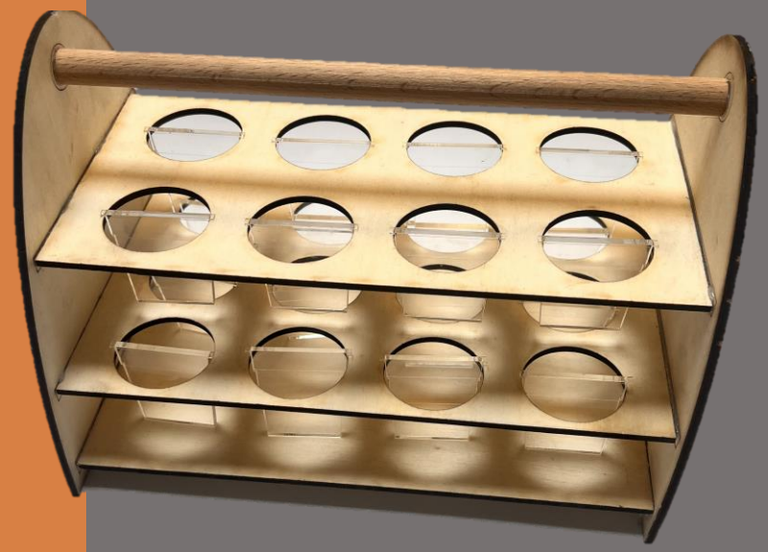
Here are some of the pots with them being filled with different things, showing the range of things to be kept in them



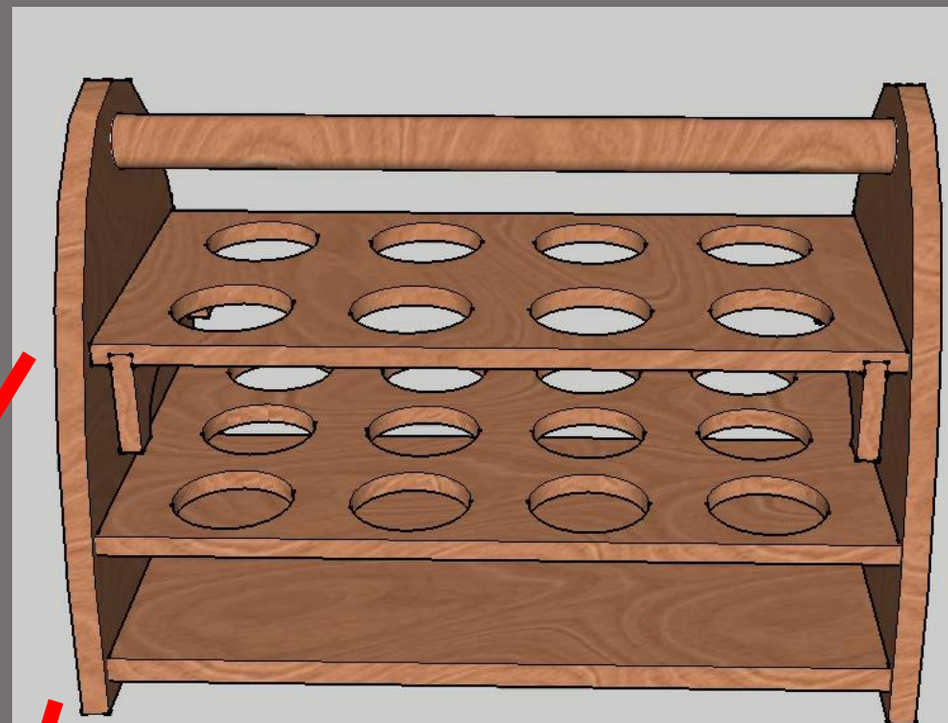
Summary and next steps:

I have decided on the size of the case which is not too big but is able to carry lots of pots.

Final Design Solution

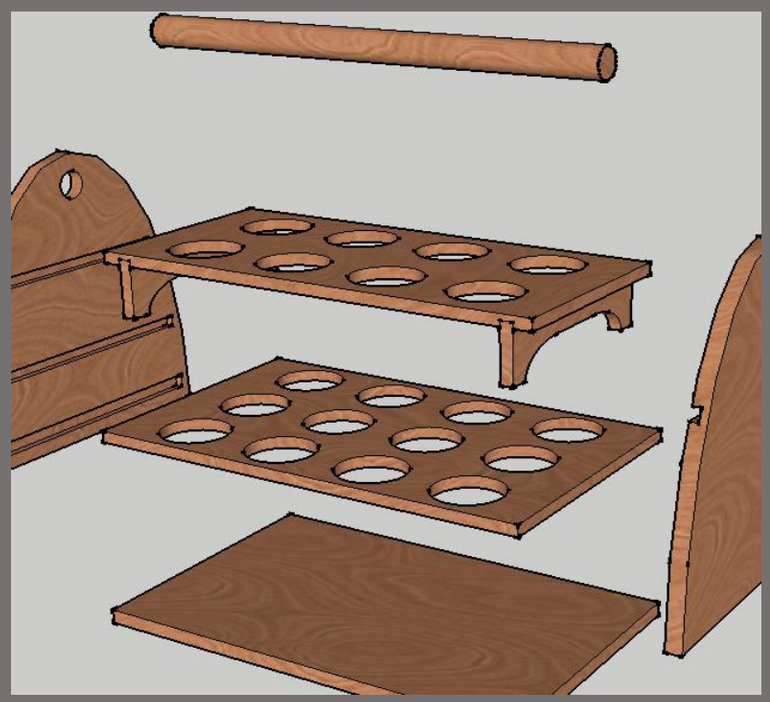


A small, simple laser cut model which shows the concept of the design. There are small 2d cups in the holes to show its function.



VIDEO

A video of the final design CAD solution shows the model from all sides.



An exploded view of the design shows all the parts separated and also shows the slots they go in.

Modelling things

Here are some picture of plastic cups filled up with items which could be stored in them.

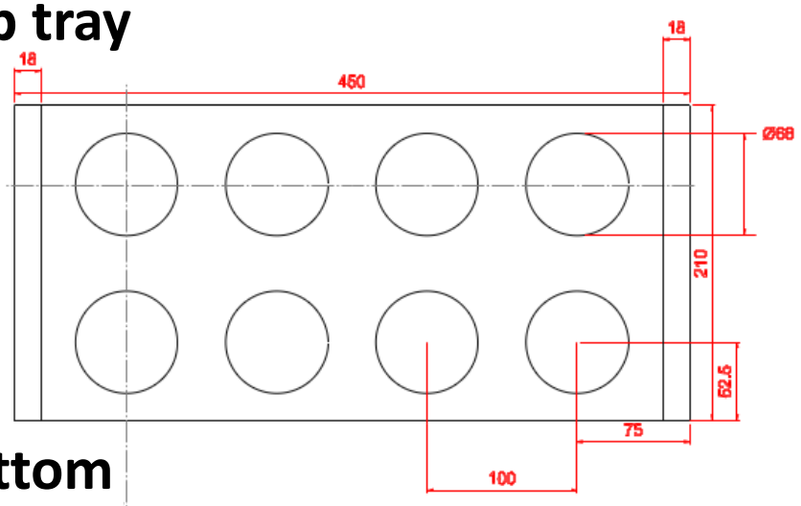
Lego figures

Technical specification

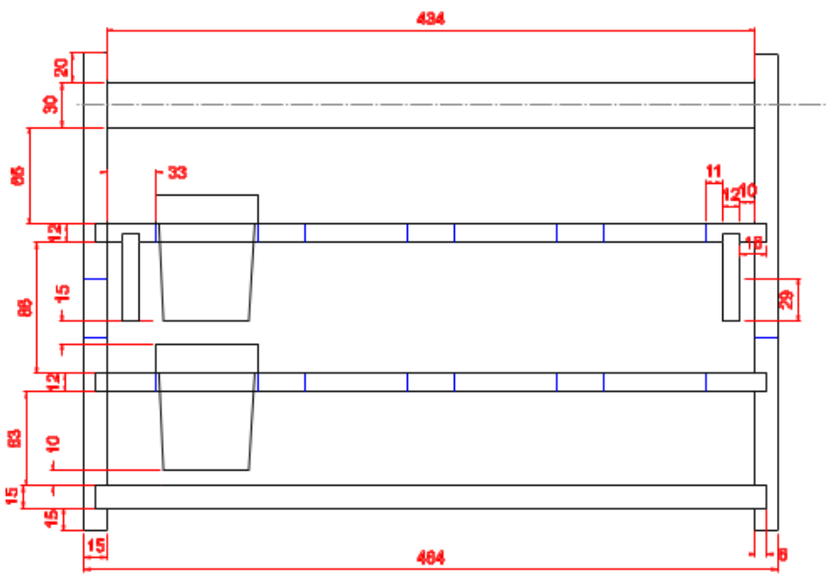
KEY:
drawing
measurements
non-visible lines

All measurements in mm

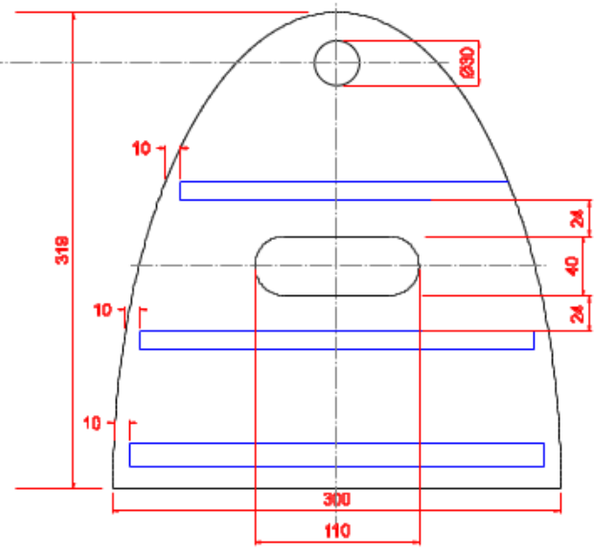
top tray



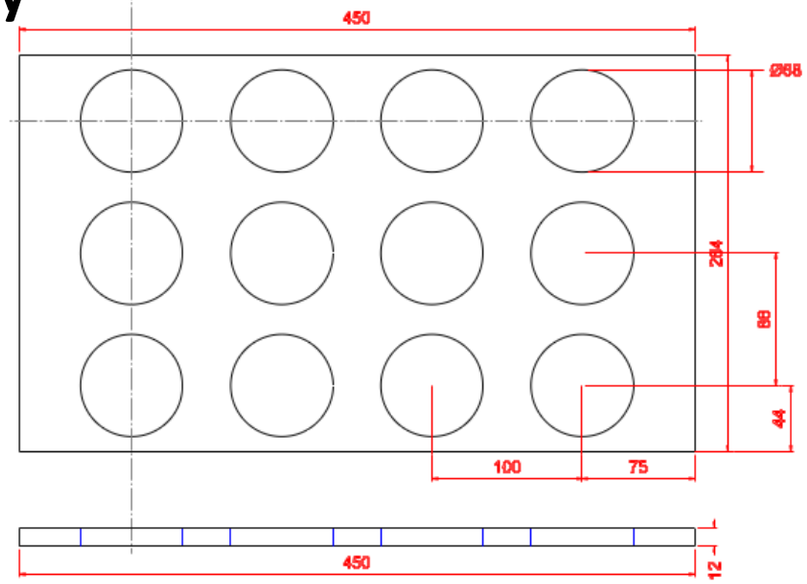
Front/full view



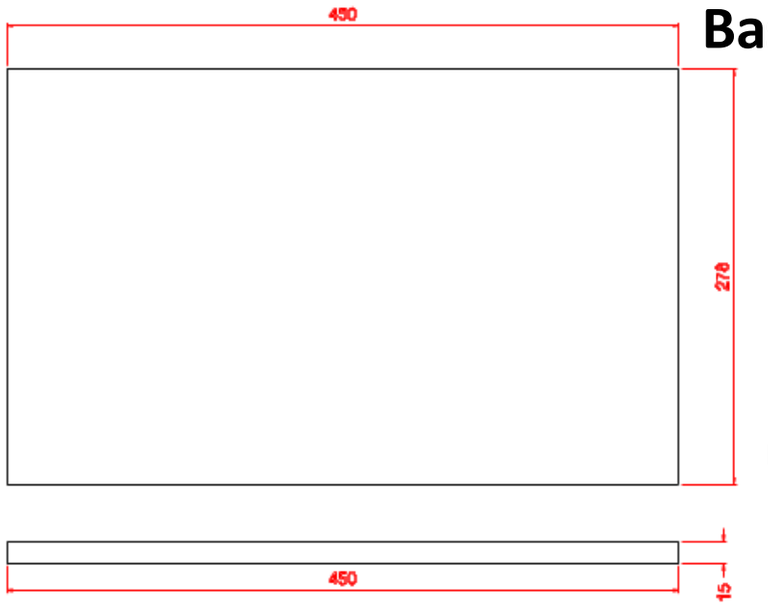
Side



Bottom tray

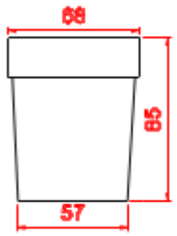


Base



Shelf/shelf legs

Cup/container



Item	Quantity	Height /mm	Width /mm	Thickness /mm	Material
Side	2	319	300	15	MDF
Top tray	1	210	450	12	MDF
Bottom tray	1	264	450	12	MDF
Tray legs	2	59	210	12	MDF
Base	1	278	450	15	MDF
Handle	1	-	464	⌀30	Oak

Summary and next steps:

Here I have designed my technical drawing for the design. I will next look into how it can be mass produced.

Large scale production

A level project

me 10:21
to info

Hi,
My name is Ben and I am currently a student in year 13 at Wallingford school. For my A-level project I am designing a carrying case for small/fragile objects. For my final design I am planning on routing the design by hand using our router at school, but I was wondering what the cost would be per unit to machine my design using more industrial equipment?

Would it be possible to send you over my CAD drawings to see how much it could potentially cost to cut one out, and would it also be possible to get the dimensions of the equipment bed you use so I can calculate how I could manufacture the design on a larger scale?

I have been in contact with a CNC routing company called TJ CNC services.

I have tried to find out some information about CNC routing at a larger scale than I have done before, such as cost per product and the size of the cutting area.

This information allows me to produce an optimal layout for how to position the trays, base, and sides on the cutting area by fitting the maximum number of full products onto 1 or 2 sheets.

Carry case project Inbox ×

Thomas Jones <thomas@tjcabinet... Dec 13, 2024, 9:49 AM (4 days ago)
to me

Hi Ben,

Thank you for your email, I'd be more than happy to have a look at your CAD drawings and see whether we can help with your project. If you send me the file as a DXF we should be able to import it straight into our CAM software. All going to plan I'd be happy to cut one out for you free of charge.

Our machine bed is 3050mm x 2060mm with clearance of 100mm.

All the best and I look forward to hearing from you.

Best wishes,

Thomas Jones

Website: https://www.tjcabinetmakers.com/
Social: https://www.instagram.com/tj_cabinetmakers/

Stages of manufacture for CNC machining:

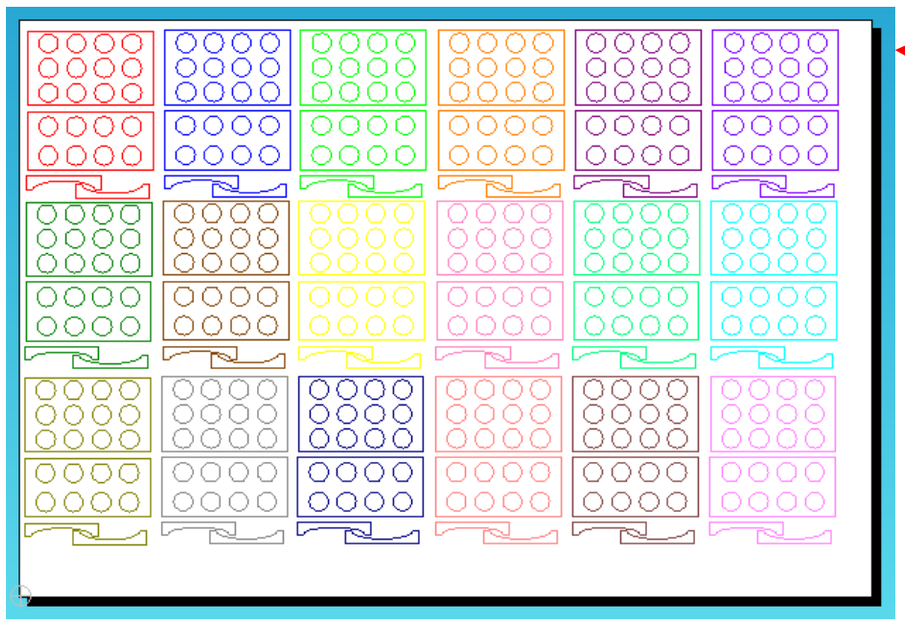
1) Design (CAD Modelling):
Using CAD software (such as 2D-design or SketchUp) a technical drawing can be made. This drawing can then be used to get all the outlines of the pieces in the correct amounts. These can then be placed onto a digital work bed (the same size as the material) to the be correctly positioned to be cut out. The software can then create toolpaths which the machine can follow to cut the pieces, this is then sent to the CNC machine.

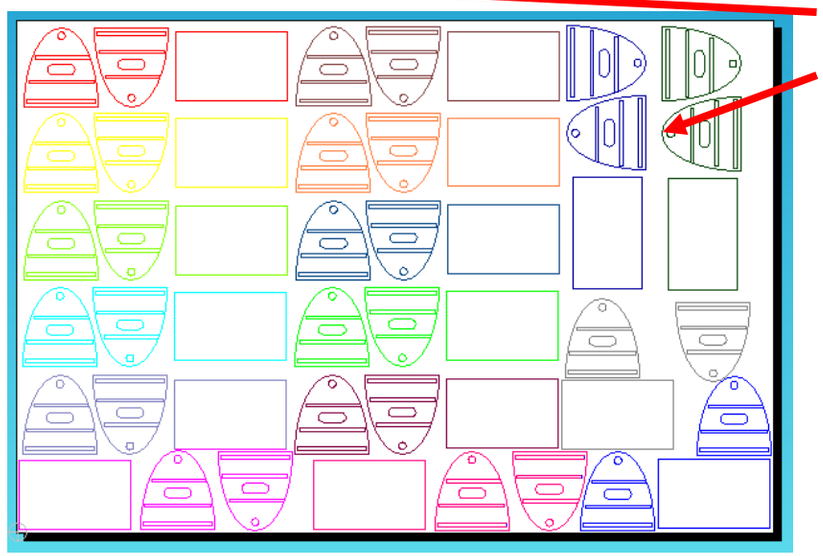
2) Material selection and preparation:
Select a stock form sheet of MDF (or materials being used) and complete a visual check on it to check its quality and suitability for the product (including the edges to check for chipping). The material can then be placed on top of the work bed in the machine.

3) Machine setup:
Turn the machine on and visually check the drill pieces to check for damage which could cause issues when cutting. Set up zero point (home) where the router will start cutting. The vacuum bed will also turn on, which will keep the pieces in place when the material is cut.

4) Machine operation:
Run the program which will start the machine which will start the pieces being cut out. The machine will cut out the smaller inside parts (like holes and slots) before cutting out the larger panels. This allows the suction bed to have maximum suction for then longest time possible. The cutter also does not cut all the way trough and leave 1-2mm left. This is then removed and cleaned after all the pieces are done.

5) Post-Processing and inspection:
The pieces can then be cut out using a Stanley knife then using a router the excess material left by the machine can be trimmed off while also making the edges slightly rounded for comfort. The pieces can then all be inspected for quality and damage, and pieces can be recut if needed.





Here are two full size sheets of the dimensions of the machine. The pieces are split into two sheets, 12mm and 15mm thickness. The 12mm can fit 18 products and the 15mm can fit 16 products which means that for 8 12mm sheet I need 9 15mm sheets to make an equal number of sides and shelves.

Summary and next steps:

Here I have show how I could potentially make my design in a larger scale manufacture (CNC routing).

Risk assessment - During manufacturing

Identify hazards	Who may be harmed and how	Severity	Control Measures	Likelihood	Risk Rating
Incompetent user	User, Bystander	HIGH	Users must not use machinery or tools that they are not competent to use. All users must be trained on the equipment before using it.	LOW	MED
Contact with router bit	User	HIGH	Do not touch moving parts of machine once in use. The router should be switched off at the mains socket when fitting or changing cutting bits on the router.	LOW	MED
Ejection of Work-piece (Kickback)	User of the tool, users of the room, the space.	HIGH	Check that material to be cut is fixed securely to the bed before switching the machine on. Take particular carewhen working with smaller pieces of material to ensure the material will not move.	MED	MED
Dust (inhalation, fire, explosion)	User of the tool, users of the room, the space.	LOW	The CNC should only be used with the dust extractor attached and working. A respirator or mask should be used whilst operating the CNC for prolonged periods.	LOW	LOW
Blade snatching or jamming	User of the tool, users of the room, the space.	LOW	Follow the manufacturer's recommended feed and speed settings. Do not exceed the recommended cutting depths. Ensure the material is free from foreign objects. Avoid making cuts that exceed the material depth.	LOW	LOW
Noise	User of the tool, users of the room.	LOW	Wear ear protection.	LOW	LOW
Flying splinters or broken router bit	User of the tool, users of the room.	MED	Follow the manufacturer's recommended feed and speed settings. Do not exceed the recommended cutting depths. Ensure the material is free from foreign objects. Avoid making cuts that exceed the material depth.	LOW	LOW

Risk assessment – When manufactured

Delivery:

	minor	significant	severe
likely	Shock/surprise from pets 1	Long Hours and High Workload 2	Pressure to Rush 3
unlikely	Cuts and Abrasions 4	Strains and Sprains 5	Unsafe Delivery Locations 6
rare	Exposure to Dust 7	Repetitive Strain Injuries (RSI) 8	Vehicle Accidents 9

1) A pet greeting the delivery person can startle them, increasing the risk of dropping a heavy package, which could lead to damage or injury.	2) Delivery people often work long shifts and are expected to meet tight deadlines. This can lead to fatigue, which increases the likelihood of accidents or mistakes.	3) There may be pressure to complete deliveries quickly, which could result in rushed handling, poor decision-making, or injuries.
4) Wooden flat pack products can sometimes have sharp edges, splinters, or exposed metal parts (e.g., screws, nails) that can cause cuts or abrasions during handling.	5) Lifting heavy or awkwardly shaped flat pack products can lead to muscle strains, back injuries, or sprains, especially if proper lifting techniques are not followed.	6) Difficult-to-access locations, such as remote areas, stairs, narrow hallways, or buildings without elevators, can increase the risk of accidents during delivery.
7) In some cases, flat pack wooden products may still contain dust from the manufacturing process, which could lead to them inhaling the dust.	8) The physical nature of lifting and carrying heavy items during regular deliveries can contribute to repetitive strain injuries over time, particularly in the back, shoulders, and wrists.	9) Delivery trucks can be involved in accidents, particularly if the driver is tired, under pressure, or in heavy traffic, posing risks to both the delivery personnel and others on the road.

Using the product:

	minor	significant	severe
likely	Repetitive Strain Injuries (RSI) 1	Injury from Tools 2	Pinched Fingers/Hands 3
unlikely	Soreness from Awkward Positions 4	Material Defects 5	Sharp Edges/Splinters 6
rare	Lifting or Moving the Assembled Product 7	Structural Failures 8	Product Instability 9

1) Repeated actions such as screwing, tightening, or lifting heavy parts can lead to repetitive strain injuries, especially in the wrists, hands, shoulders, and back.	2) Using tools like screwdrivers, hammers, or drills during assembly can lead to cuts, puncture wounds, or eye injuries if safety precautions (e.g., goggles, gloves) aren't used.	3) While assembling the flat pack product, fingers or hands may get pinched between components or during tightening or positioning.
4) Some awkward or prolonged body positions during assembly might lead to minor soreness in the neck, shoulders, or back, but these issues are typically temporary.	5) Hidden flaws in the wooden components (e.g., internal cracks or warps not visible during assembly) could cause sudden product failure while in use, potentially resulting in injury.	6) Rough edges or splinters on the wooden components can cause cuts or irritation during assembly or use, especially if the person handling the product is not wearing protective gloves.
7) Moving a large, fully assembled product can cause injury if it is too heavy, awkward to handle, or if proper lifting techniques are not used.	8) Incorrectly assembling the product (e.g., missing screws, misaligned parts) can lead to instability or collapse, posing a risk of injury, such as falling objects or the product tipping over.	9) If the flat pack product was not assembled correctly or is structurally weak, it may break or collapse under weight, leading to potential injuries like falling objects or the person being knocked over.

Summary and next steps:

I have come up with risk assessments for each stage of the product before it reaches the end user. Next I will come up with a simple plan of making which will outline the steps I need to complete to manufacture my product.

Plan of making

Task	Material	Quantity	Equipment, tools and processes	Health and safety	Quality control
1) Cutting out piece template.	Laser-ply	2 sides, 1 top tray, 2 legs, 1 bottom tray.	Laser cutter	Care should be had around the machine when used. You must not look directly at the laser as it could damage your eyes. Extraction should be used to remove the dust and toxic fumes from the chamber.	Carried out using a laser cutter ensures high accuracy and precision of the finished parts.
2) Using template to cut out final pieces.	12mm and 15mm MDF sheets	2 sides, 1 top tray, 2 legs, 1 bottom tray.	Jigsaw, table saw, pillar drill	Ensure a trained person carries out this task. Protective gear (like gloves and googles) should also be worn to protect from slinters and dust when cutting	Compare the side pieces to the template, complete a visual check to see if they are the same.
3) Cutting the grooves, slots and holes for the trays and pots.	12mm and 15mm MDF sheets	4 grooves, 2 slots and 20 holes.	Hand router	Ensure extra care is when using the dangerous tools e.g. router. This is due to the injuries it can cause if misused. Googles and face protection should be worn to protect from the dust. Positive extraction should also be used to minimise the dust in the air.	Check that there are no tear-outs or chips in the wood. This can be done with a visual check.
Alt 1-3) Cutting out all my pieces – done by **TJ CNC services**	12mm and 15mm MDF sheets	2 sides, 1 top tray, 2 legs, 1 bottom tray.	Industrial CNC router	Ensure a trained person carries out this task. Protective gear (like gloves and googles) should also be worn to protect from slinters and dust when cutting.	Carried out using a CNC router machine to ensure accuracy and precision to ensure all parts fit together well.
4) Squaring off the slots	12mm and 15mm MDF sheets	4 grooves, 2 slots	Mallet, chisel, pencil, setsquare.	Extra care should be taken when using a sharp chisel and mallet. Supervision could be a possibility to ensure the tools are being used correctly.	Use a set square or a straight edge to make sure the ends are as square as they can be.
5) Round of the sides of all the parts	12mm and 15mm MDF sheets	2 sides, 1 top tray, 2 legs, 1 bottom tray.	Hand router	———	Check that there are no tear-outs or chips in the wood. This can be done with a visual check.
6) Fit top handle	30mm hardwood rod	1 top handle	———	Be careful when pushing the rod in to not trap your fingers in the gap. Gloves can make it harder to do this but can make the pushing more difficult	Ensure that the rod fits well and doesn't rotate or slide when in the hole.

<u>Quality assurance:</u>

- Selecting correct material (grade, thickness)
- Check/inspect for damage on the drill pieces
- Calibrate machine – to make sure there are no errors in the cutting.
- Post cutting tolerance check – see if the cut pieces are within the required tolerance.

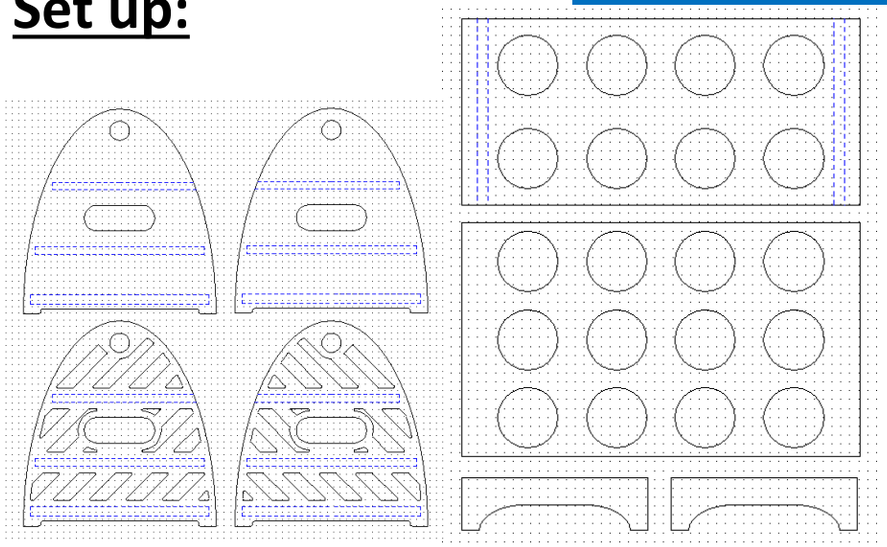
<u>Summary and next steps:</u>

I have come up with a plan on how I will make the prototype and how I will minimise the risks associated with the manufacture. Next I will start manufacturing the prototype and produce and process of making.

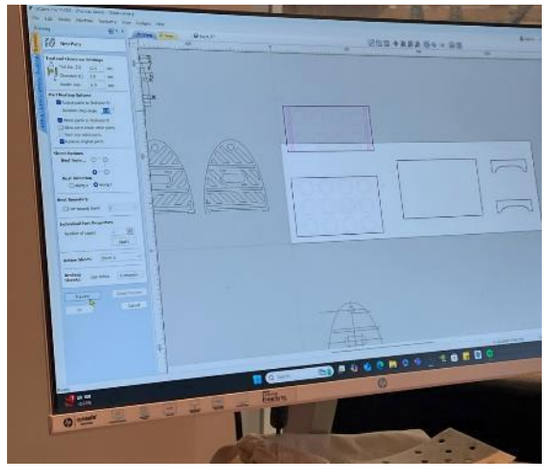
Process of making

ALL photos in this section have been taken by me

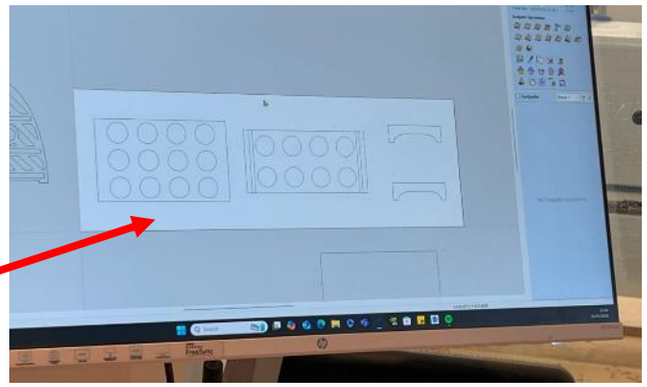
Set up:



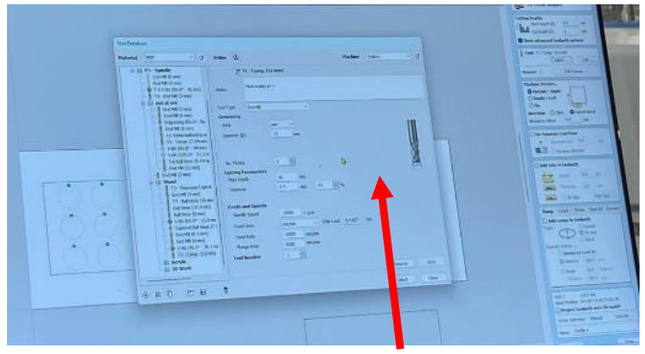
1 **To start I split my technical drawings into the two different thicknesses (12mm and 15mm). These were then sent off the CNC company.**



All of the pieces are able to fit onto the material with extra space between the pieces to make to easier to cut out.

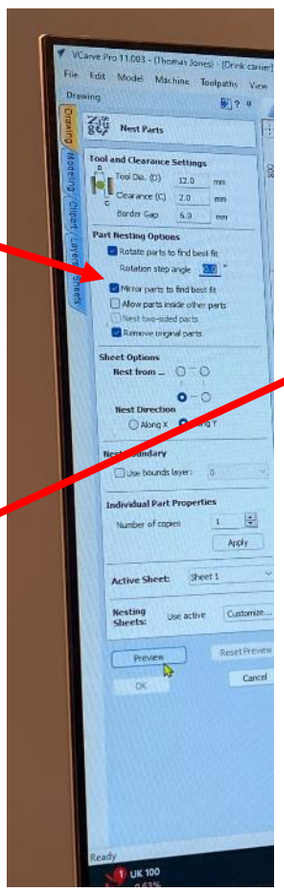


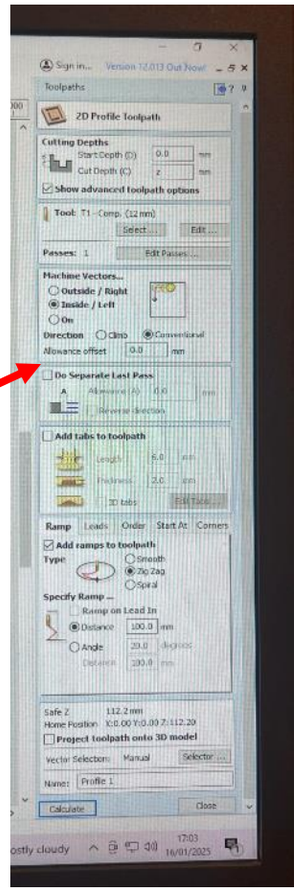
2 **These two files were then imported into their software, which then allowed them to fit them to the size of material and also allow them to change the type of drill bit for each cut.**



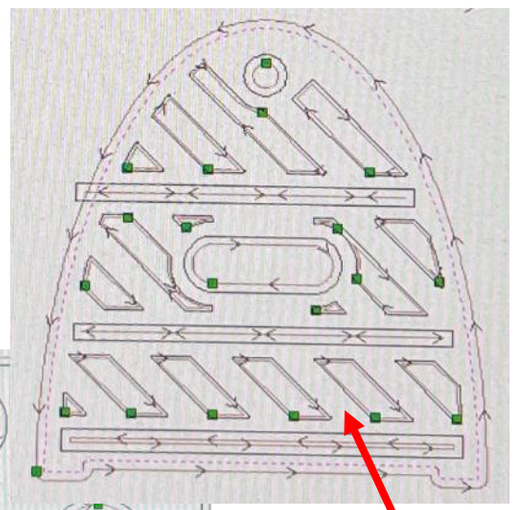
Choosing type of drill bit

3 **The depth of the slots can also be set at this point to accurately set the depth of the cuts. The full cut was also set to ≈ 1mm to stop the piece from moving when being cut if the suction was not enough to hold it in place**

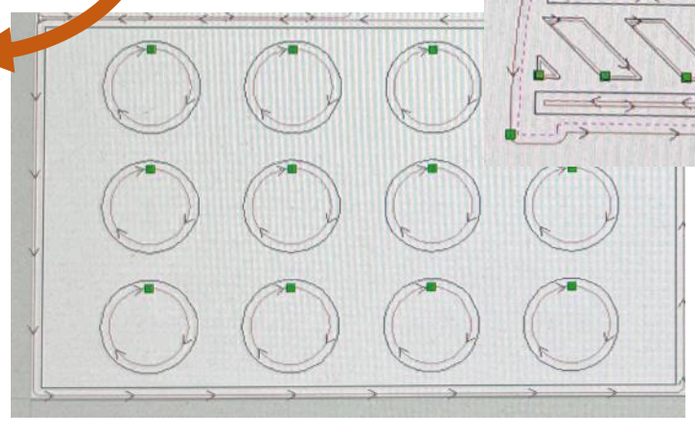




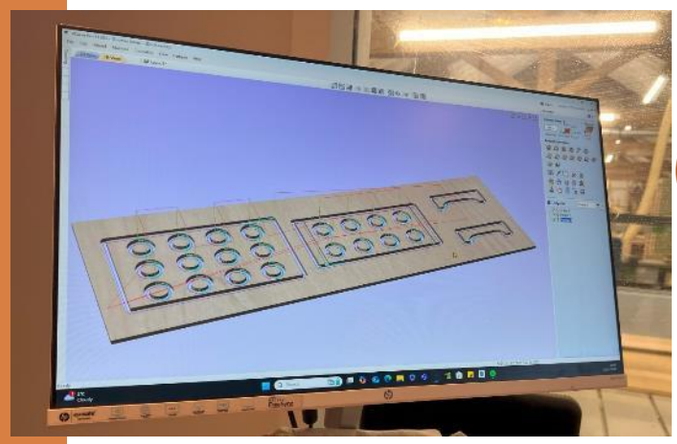
4 **The tool paths were then added to the program. These tell the machine the path the drill bit needs to take to cut out the shape**



The smaller out cuts are done first, which means the main frame doesn't move when the out cuts are done



5 **The tool paths can then be displayed visually with the depths of cut shown**



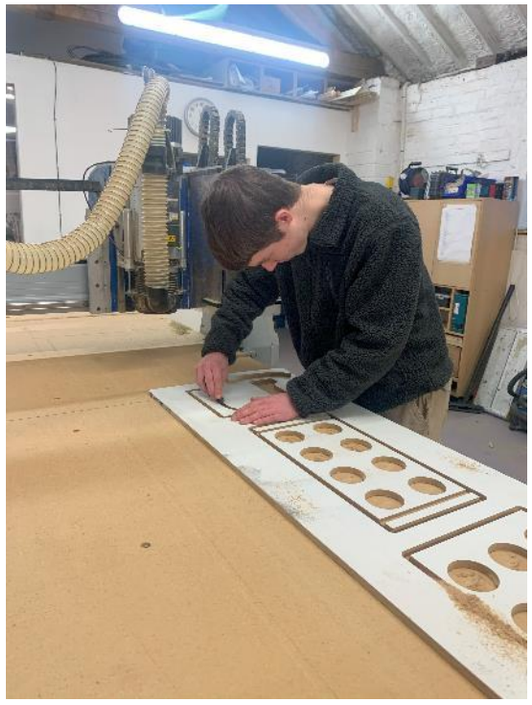
Process of making

Manufacturing/cutting test pieces:

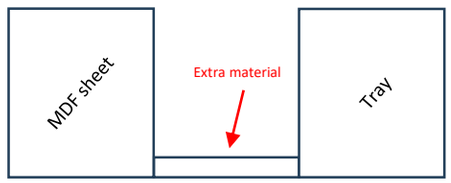
1 The sheet of MDF is then put into the machine which follows the paths calculated by the computer.

2 After cutting out all the holes in the trays the machine is paused to remove the loose parts and is then started up again to finish cutting out the trays.

3 The pieces then need to be cut out due to the extra piece of material stopping them moving. The small layer is left to allow a large surface area for the suction (which is used to hold them down) to still be able to hold the sheet down. This was done with a folding utility knife



4 I then used a router to trim off the excess material left behind from cutting it out. This involved holding the tray flat while the router with base was moved around the edge of the tray



Process of making

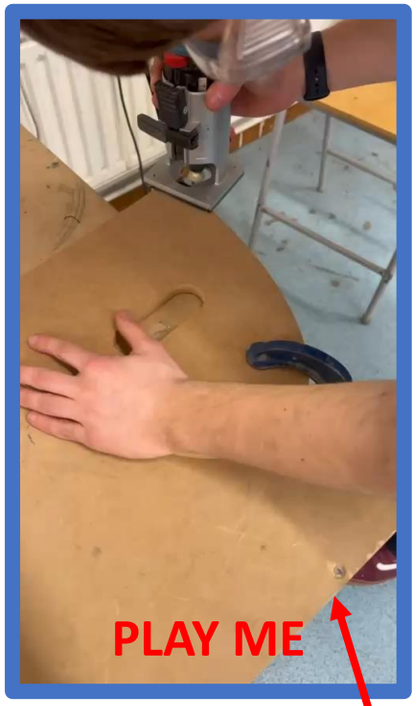
Manufacturing/cutting final parts:

1 **The sheet of MDF is then put into the machine and the parts are cut out in the same way as the test pieces.**

2 **After cutting out all the pieces I thin used a router on all the edges to curve them end make them more ergonomic.**

I used masking tape to cover the hole to allow the router to travel over the gap.

Here a scrap piece of MDF was used to test the router.

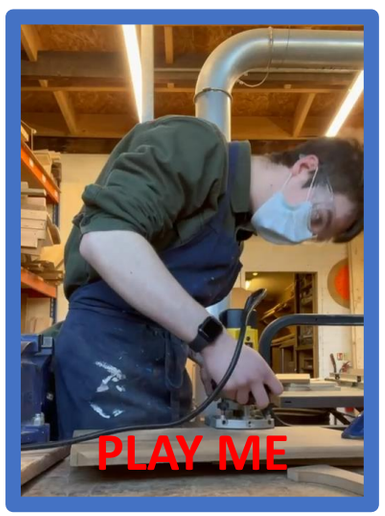


This video shows me using a router to round the edges of one of the sides. In the video I am wearing PPE (mask and eye protection) as well as having clamped the piece down to stop it from moving.

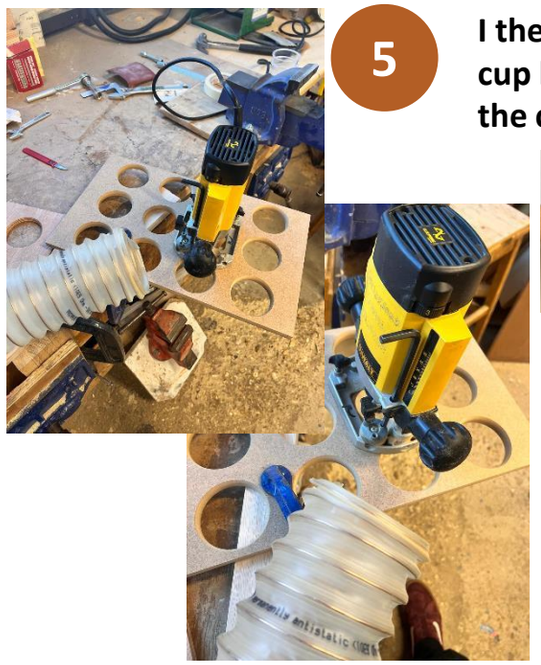
When routing the shelves I also has positive extraction to help remove some of the dust produced.

3 **Then using a chisel and a mallet I squared off the edges so that the trays can fit in the sides.**

4 **When chiselling, one of the sides split at the base so I had to glue it together to fix it.**



Process of making

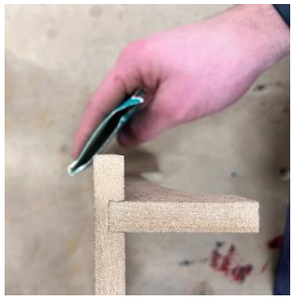


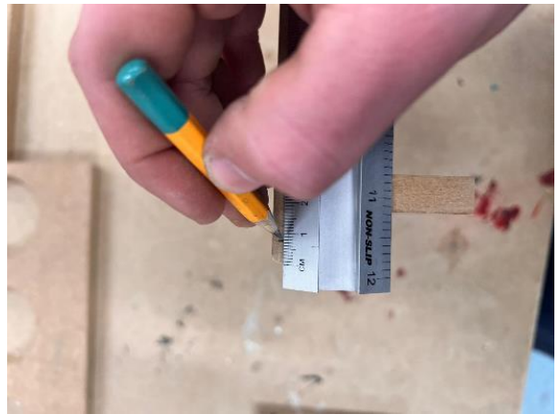
5

I then used a router to curve the cup holes to make it easier to take the cups in and out.

6

Using some sandpaper I slightly rounded the ends of the trays to make them easier to move in and out.





7

I then marked out where how far the tray needs to go in so that I can make sure the in cuts are deeps enough to fit the trays; so that when I push them together, I can make sure they fit.

8

I sanded the ends of the rod to allow an easy but secure fit into the side pieces

9

All the pieces are pushed together which forms a strong and secure final prototype

Problems that occurred during manufacture

Issue	Solution	Outcome
Due to the tray slot making a hole in the end pieces, when routing there was a scuff/divot where the wheel of the router should run.	Either use some tape or some filler material so that the router wheel has something to run over.	The scuff became less noticeable. In final/mass manufacture a specialised piece could be put incise to allow for a moan easier finish.
When making the rod ends the correct size, I took too much material off the end which means that the handle isn't as secure as the other parts.	If I wet the holes the handle goes in then the MDF will expand slightly making it a tighter fit.	The handle became more secure and doesn't rotate in the holes, making it easier to carry and move around

Showcase of product

Showcase of product (in use)

You can see here that they have spare parts which need to be added in a pot which has been removed from the tray. This makes it easier to access the parts and keeps them all in one place.

These pots also have parts in but are kept in the tray as they are not needed at this point of time.

All of the pots are kept in the tray to organise them so parts don't get lost or confused but they could be taken out if things needed to be put in/taken out.

Here you can see that the top tray is being used separately to the rest of the case. This allows more space to be used doing the hobby while also having access to everything needed.

<u>Summary and next steps:</u>
Here are some pictures of my product in use. Next I will work out the costs in making it.

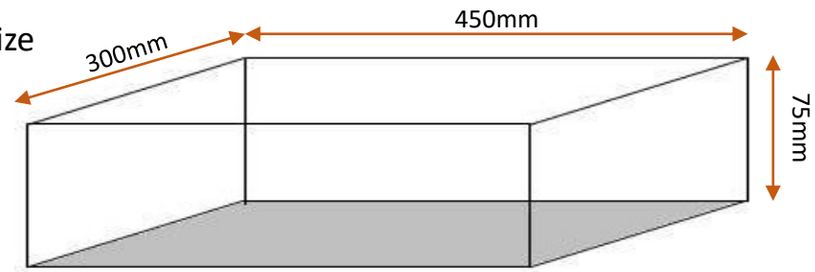
Delivery

Flat packing:

Benefits of flat packing:

- Easy transportation
  - A smaller flat box is easier to carry and move around as well as being easier to stack
- Space efficiency
  - Less space taken up means that more can be fit in a van or they will take up less space in storage.
- Eco-Friendly
  - Reduced packaging size leads to less packaging being used, as well as CO_2
- Customisation & Modularity
  - The parts being separate then parts can be easily swapped out and replaced if they are alternate designs or shapes of the product

Rough flat pack box size



Costs:

- Wage for the worker(s)

↘ Average hourly wage for a job like this is about £20. I will take 2 hours to cut 17 products out which is about 7 mins per product, plus about 10 mins to package and ship each one. That works out to be about 17 mins per product which is £5.67.

- Cost of material

Sheet material of MDF of 3050mm x 2060mm x 15mm dimensions is about £50 per sheet (which makes 17 cases) but 2 sheets are needed for the different thicknesses. Per case it costs £5.88.

- Running machinery

↘ £30/hour so cost of running so for 2 hours of running it would cost £60. £3.53 per case.

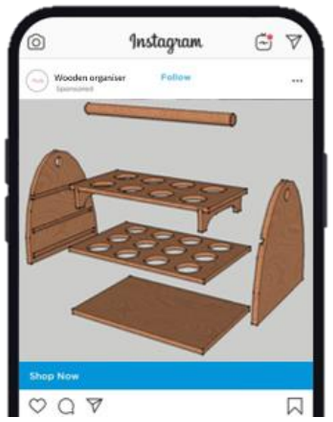
- Delivery/shipping

Royal Mail	Royal Mail 48® - Tracked	2 to 3 days	£5.95	£7.14
Royal Mail	Royal Mail 48® - Tracked & Signed	2 to 3 days	£6.95	£8.34
Royal Mail	Royal Mail 24® - Tracked & Signed	1 day	£7.85	£9.42
Royal Mail	Royal Mail 24®	1 day	£7.95	£9.54
Royal Mail	Royal Mail 24® - Tracked	1 day	£8.00	£9.60

Total cost per product is £22.22.

How to market the product?

- To market my final product, I will use direct marketing.
- I could put adverts /marketing pages on social medias (like Instagram) that will get shown to relevant accounts which could increase sales or exposure for the product.
- I could also put pages in relevant magazines (for example modelling or DIY ones). This again will increase the exposure of the product.
- I could create a website to sell the product and any other future products.
- And I could go to craft or relevant fairs to sell/show off my product and hopefully increase exposure by word of mouth between hobbyists.



Profit:

Profit margin should be between 50% and 75%. I think the best profit margin is 65% which would bring it case to a cost of £60. As the cost is £22.22 and the profit is £37.78.

Summary and next steps:

I have researched into methods of delivery and I think that flack packing will be the best way due to it being cost effective. Next I will to into the analysis of my final prototype, comparing it to it's requirements and getting final feedback from end users.

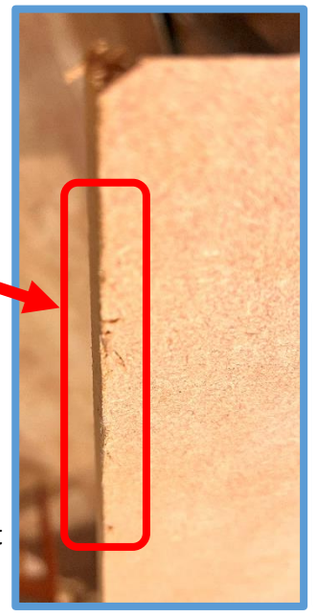
Analysis of final product

Stakeholder and Technical requirements	Has the requirement been met?	Req't met?
Large capacity	The case can carry 20 pots or a selection of larger and smaller pots. With all these pots the case has the capacity to carry lots of different items. Which is required from having a large capacity	☑
Lightweight casing	When the case is not filled up then it case doesn't weigh too much as is comfortable to carry, although when filled up with lots of heavy items then it becomes quite heavy. The weight of the case despend on what is put inside.	☑
Organisation methods are included	The case is designed to carry lots of different pots, which can be used to sort and hold different items from many different types of hobbies	☑
Plug socets/an electrical supply	The case does not have any sockets or an electrical supply. It does not fulfill the requirement but I decided in the design process that it was not as important to include as some of the other requirements	☒
Battery charging	The case does not include anyway of charging batteries. If it was a popular addon then the design could be changed/adapted so that it can hold a battery charging case somewhere.	☒
Lighting	It does not contain any lighting in itself but has many different place in which a light could be clipped.	☑
Portable	Large top handle paired with the two side handles allows the case to be easily picked up in either way. The case has a removable tray which allows the separate parts to be move around seperately	☑
Secure water seal/weather proof	All the pots come with plastic lids which fit securely creating a waterproof seal for the containers. The MDF that it is made from is not finished and could be easily damaged by water	☑
Made from sustainable materials	Made from MDF which is a realtively sustainable materal as it is made from recycles wood fibres and dust. This means the offcuts and sawdust can be reused or recycled	☑
Durable	MDF is a very durable material as the fibers are bonded together with resins which create stable and strong bonds. It is made from wooden fibers being compressed together which created a dense and uniform structure which makes it more durable.	☑

Physical testing

Material is dented but it is difficult to see.

I did some physical tests, which included hit and drop tests. After dropping the material a few times, the edge became dented and frayed which doesn't look nice, but with the case having a curved edge it may not become as bad.
I also struck the material with a hammer to see how easy it was to dent. I was relatively difficult and was it did become dented it wasn't very visible.



I added weight to the shelves to see how much they could take. The two paint cans combined weigh 9.4kg which is way more than would be possible to fit in the trays. Even with this much weight added it still works with only a slight bend towards the middle.

Evaluation of final prototype

I took my product to an ADMRC meeting and also to someone who is into DIY. This was the feedback that he and several members gave me:

Strengths:

Made from wood

↘ The use of wood means that the prototype is sustainable as it can be recycled at the end of its life. It also means that it is strong but lightweight.

Sturdy construction

↘ With the use of thicker side panels, cross supporting shelves and handle, all the parts of the design work to form a strong and stable construction as well as having individual functions (like holding containers).

Aesthetic appeal

↘ Due to the wooden construction and modified side panels the prototype has an appeal due to its more interesting style.

Lightweight construction

↘ Made from wood and with cut-outs which reduces the overall weight of the case so when filled it won't be as heavy.

Portable

↘ With the large carry handle at the top and two handles on the side it makes it easy to carry and move around

Efficient storage

↘ The two layered design and the removable tray maximises space efficiency, allowing more storage to be has/used in a smaller product.

Weaknesses:

- Limited storage size/compatibility

↘ Not all cups/containers will be able to fit in the holes (if the supplied cups were to be replaced), so some way to change the size of the holes to fit more sizes would be good.

- Uneven weight distribution

↘ If the trays are placed unevenly across the design, then the container could tilt forwards or backwards, which would make it harder to carry.

- Potential for the try to slide out

↘ The tray currently does not have any way of being secured, which could cause the tray to side out when being moved around.

- Limited load/maximum load

↘ Due to the material restriction the case will only be able to hold a certain weight before it breaks or is unable to be carried.

What end users liked about the design:

Simplicity of design
Aesthetically pleasing
Robust!
• STABLE
• WELL BUILT.
• GOOD FOR LOOSE/SMALL PARTS.
• USEFUL POTS.

Ability to remove individual trays from the main tool box & also the individual pots.

Well built and with clean lines.

Fretwork on the sides is both aesthetically pleasing & also saves weight without compromising strength

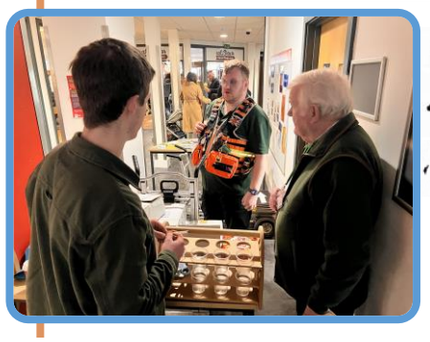
It is well made and designed.

Things that came up often:
- Stable/durable
- Well built
- Looks good/aesthetically pleasing

These are things that I have done well as multiple people have picked up on them.

Other positives included;
- Weight saving design
- Simple
- Design works well for smaller parts

What end users thought could be improved:



• SMALLER HOLES FOR PAINT
• SEPARATE MODULES FOR UNIVERSAL USE
• DRAWS FOR TOOLS.

Space for large items. modular boxes Somehow? (different lengths & widths etc.)

If bespoke then make set options for customisability.

Adding a drawer (drawers) that can be taken out would be useful. Also instead of cubs have handles on a ~~Rectangular~~ rectangular storage containers

Alternate modules e.g. drawers, shelf with smaller holes for enamel paints

Flexibility in design

How tall might it fit in units

Different colours.

e.g. Kallax Billy other designers are available!

Replacing circular containers with oblong ones would be more useful.

~~Also~~ Also, the lower section could be replaced by two trays with hinged lids as most tools & ~~paint~~ paint brushes are elongate.

Things that came up often:
- Not enough space for larger tools
- Modular design
- Specialised holes
- Replacing circular pots

All these came up more than once which means that they need to be fixed and improved on.

Other more specific issues where:
- Colours/variety
- Universal use

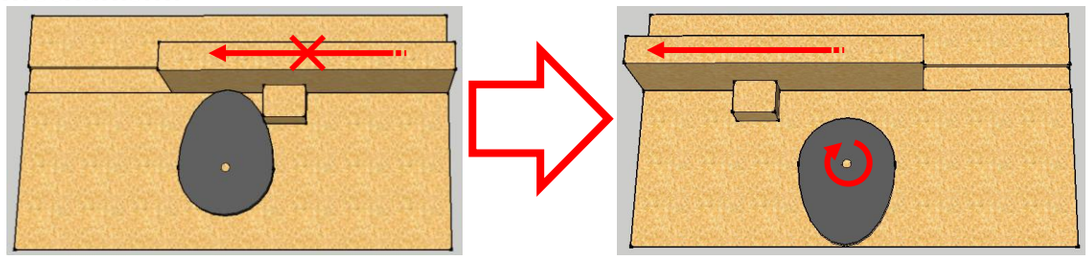
Evaluation of final prototype

Using the feedback that I received from ADMRC and the DIY enthusiast I have come up with 7 different modifications which could be made.

Suitable modifications:

Locking mechanism:

1

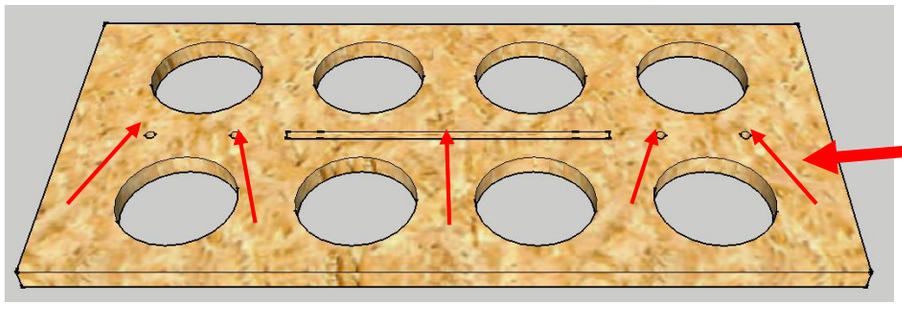


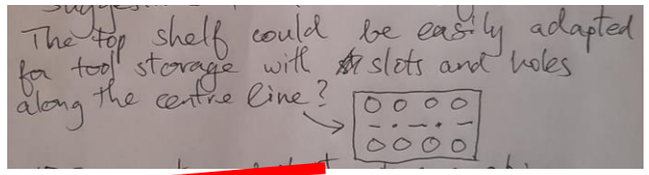
I added a cam lock to stop the tray from sliding out. When in the upright position the cam blocks the stopper block which doesn't allow the tray to move. When turned 180° the cam no longer blocks the paths and the tray can be pulled out.

- Stops the tray from sliding out and damaging itself.
- Makes the manufacture more complicated with more smaller parts added.

Smaller storage slots:

2



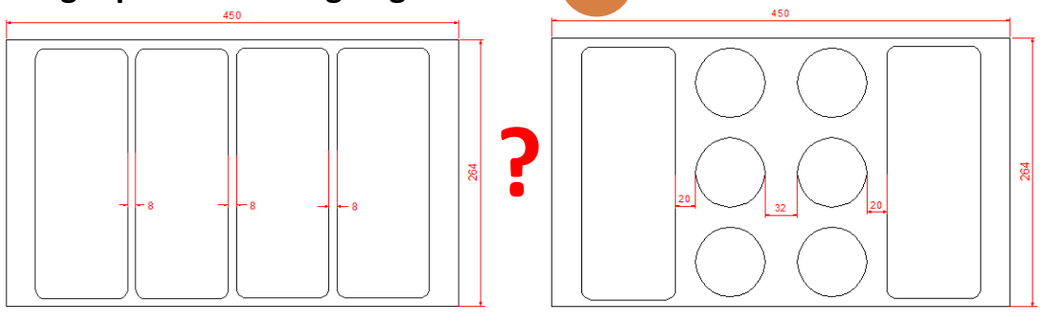


I added some smaller holes down the centre line which could be used for holding brushes vertically or lying down.

- Allows brushed to be held vertically, not damaging the bristles
- Brushes could get caught in the tray below and stop the sliding or break the brushes

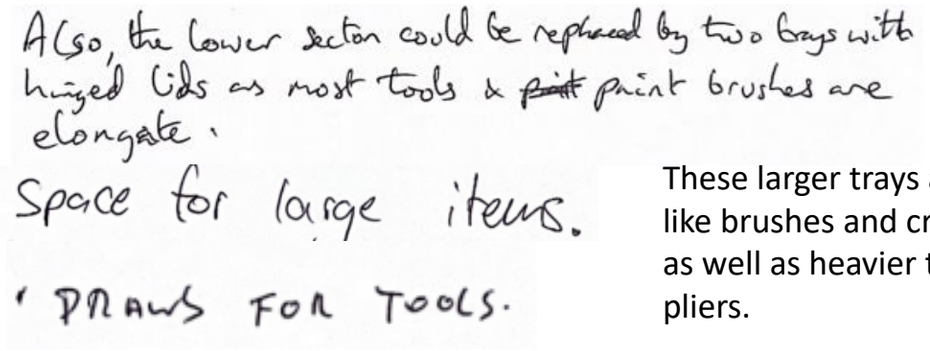
Larger pots for storing larger tools:

3



If the bottom tray is fully replaced by the larger tray the gap between the slots is too small which would compromise the strength of the tray.

To counter that the two middle ones can be kept as cups which keeps the strength of the try.

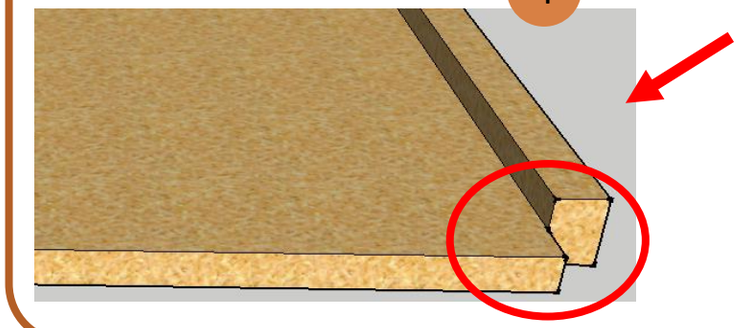


These larger trays allow for longer tools like brushes and craft knifes to be stored as well as heavier tools like snips or pliers.

- Larger pots allows for storage of bigger items which are needed to carry out the work
- Less material in the tray so it is weaker and less stable.

Ledge for sheet material:

4



The ledge could create an issue when manufacturing with lots of wastage being created or weaker join between two wooden faces

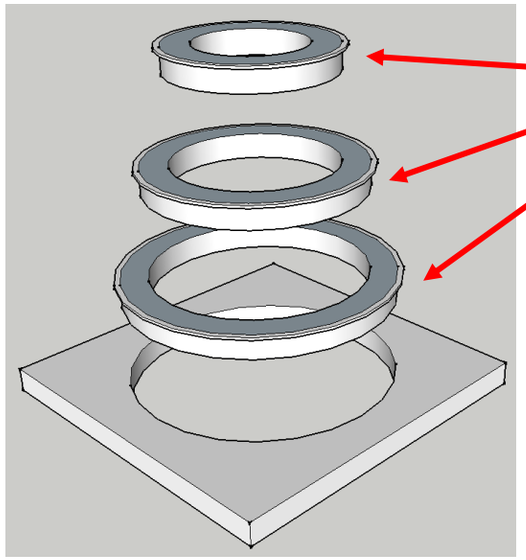
A ledge could be added to the base of the product to allow sheet material to be stored underneath the bottom tray, as there is space under the pots which is not being used.

- Allows sheet material to be easily moved around with all the equipment needed
- Makes the manufacture process more complicated by either joining two parts or creating more wastage

Evaluation of final prototype

More suitable modifications:

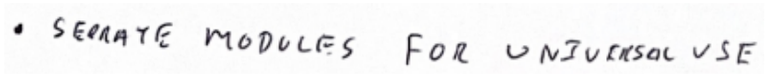
Universal holes:



5

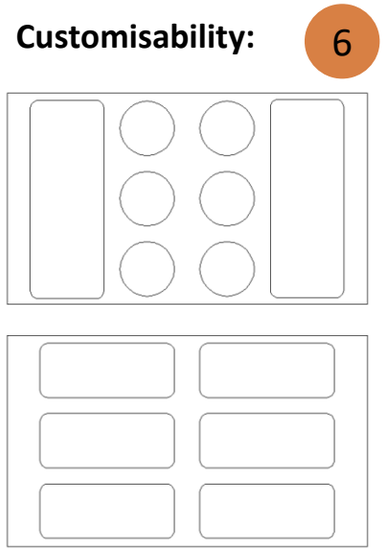
Some rings could be sold/made so that you can change the size of the hole to allow for any pot/circular container to be used if a different size it better to be used.

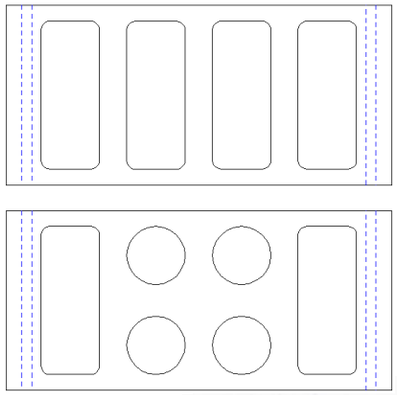
- Allows more container to be used, reduced waste/unnecessary buying to get pots which fit the holes.
- The rings means that the pot holders will not be as strong and will not be able to take as much weight.



Customisability:

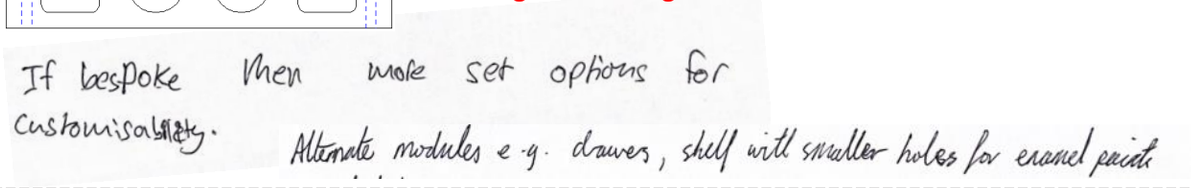
6





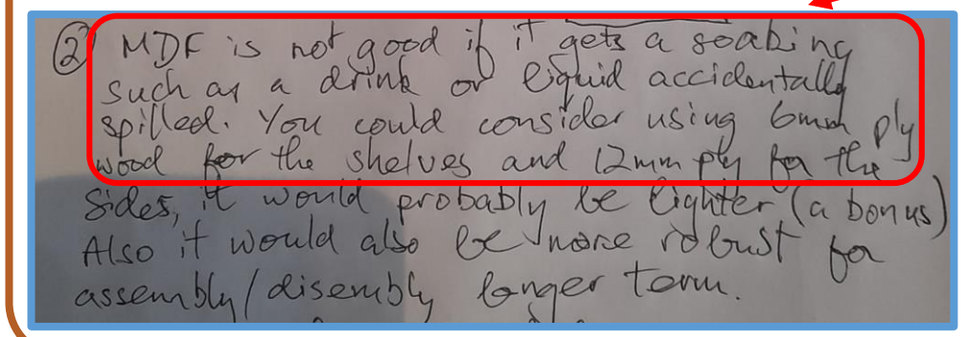
Some level of customisability could be added to the design/website. The holes could be changed out for large/medium trays or a selection of pots.

- Allows for some input from the customer which gives them a greater connection to it and also allows them to change it for their needs
- The customisability will create a larger complexity do the design increasing the manufacture time and cost



Material:

7



MDF is a sustainable material as it uses fibres and sawdust from other woods. But due to being a manufactured board it is more sensitive to water. Could use Ply wood instead?

- Means that the case is less responsive to water and weather conditions
- Ply tends to splinter and is harder to achieve a smoother surface with.

Design optimisation:

All of these modifications would affect multiple elements of the product and would need to be considered to see if they were viable options to implement.

Retail cost:

All of the modifications would add to the cost of the final product.
Modifications 2,4 & 5 could be considered to be add-ons if wanted be the end user which would allow the cost to be minimised while also giving access to the features if needed.

Complexity:

Modifications 1 & 5 would drastically increase the complexity of the designing. Both modifications would require testing to see if they improve the function in anyway. They would have to be tested against lots of weight and force to improve their function against a fully filled product.

Modification 6 would make the shipping and manufacture process more complex as they have to be designed according to the needs which would make them different for everyone. This would make it difficult to mass manufacture and would have to do smaller scale manufacture, making the lead times longer.

Product lifecycle:

Modifications 1 & 5 could potentially break or get lost after lots of use. This means that their modular design allows them to be easily replaced ad they won't need to be specially design for each person's design, which would allow for easier repair with spare parts being able to be sent and be fixed by the user themselves.

Changes to plan of making

Which occurred during manufacture or could be changed to improve the process.

The first 3 steps were not used as the pieces were cut out by a CNC company.

Task
1) Cutting out piece template.
2) Using template to cut out final pieces.
3) Cutting the grooves, slots and holes for the trays and pots.
Alt 1-3) Cutting out all my pieces – done by **TJ CNC services**
4) Squaring off the slots
5) Round of the sides of all the parts
6) Fit top handle

Having multiple lines instead of a single continuous line in the CAD drawing will complicate the generation of tool paths. It took time to clean up the drawing before it could be used properly. Once that was fixed the process of cutting was very quick.

There was a step added between 1 and 2, which was to trim and clean up the pieces after they came out of the CNC router before I could start rounding the pieces over. This was unforeseen as I haven't had anything cut from a router before but it looks like it is a regular step which occurs.

I decided not to round all the edges as some were being slotted into the side pieces and being rounded off would have made them loose the friction fit I was hoping for. The main top tray piece was also not rounded off all the way around as where the leg slots were would have looked wrong if rounded.

I had to add another step which involved hand sanding the parts, due to the CNC machine cutting a bit smaller than expected. Making the slots a little bigger on the drawing could save time on sanding. That way less handwork would be needed to fit everything together.

Sourcing the 30mm wooden rod was quite difficult as it is not a stock form of wooden rod. To make this easier the rod could be made 32mm or 28mm which both would have been easier to get.

Review and reflection

Value of the client:

The feedback from my clients throughout the development process was very important. It allowed my design to go the way that they wanted and in which there was a gap in the market, as they are the people which the market is targeted towards. This allowed me to focus my design process towards something which would make an impact if sold. They also give me specific things that they needed to fit or carry around (e.g. paint pots).

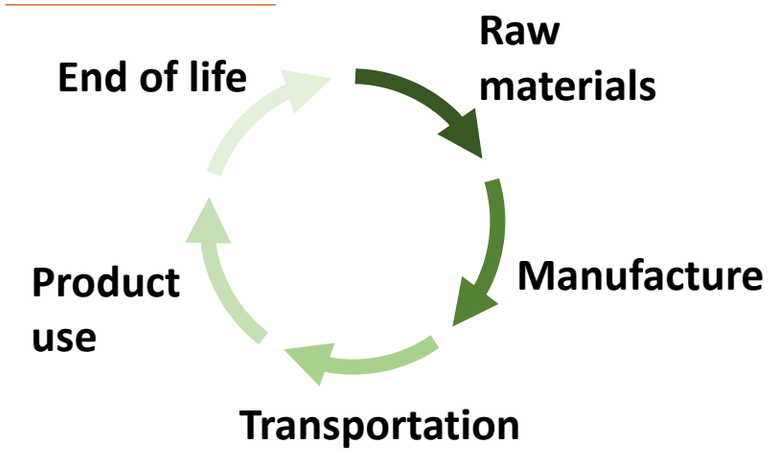
The importance of the stages of development:

Initial ideas allowed me to come up with many different designs which could the be compared to user requirements and also given to my end users. The feedback from this could then be used to choose and continue to develop my chosen design into a final product. The development stage was helpful as it incorporated continuous feedback from end users and improving the design, which allowed a solution to be found efficiently. Evaluation allowed me to look back and find the issues and ways to improve it.

Summary and next steps:

Here I have looked into what the manufacture process actually was compared to what I thought it was going to be. It is interesting the slight difference for example the cleaning up of pieces after they were cut out. The small amount of refection on the client and the importance of development also shows how important it is to include lots of different people in the process.

Lifecycle



Reduce:
Amount of waste martial and packaging. This can be done by tessellating the pieces when cut out to reduce space between parts, and to back the parts more efficiently to minimise space between the parts.

Reuse:
The MDF is made up of wood dust which can be obtained from wood offcuts from other companies which were just going to be thrown away.

Recycle:
Setting up ways that the MDF can be recycled (as it can't be everywhere). So, the seller (me) could set up a scheme where old cases that are wanted to be disposed of could be collected so they can be broken down and the material reused.

Repair:
Wood filler can be used to fill in dents and scratches but if a whole part gets broken it will be difficult to repair while retaining the original strength, which is where replacements could be suppled/sold by the company.

LCA (lifecycle assessment):

1) Raw materials

Materials:
- Wood fibres obtained from fast growing soft woods or wood waste.
- Resin used are usually formaldehyde-based used to hold the fibres together.

Environmental issues:
- Deforestation (if not sourced sustainably)
- Engy used in deforestation processes
- Co2/emissions released in deforestation and resin production

2) Manufacture

Processes:
- Drying wood fibres
- Mixing fibres and resin
- Pressing mix to form sheets

Environmental issues:
- High energy use
- Waste materials (rejected after inspection, off-cuts from pressing, etc.)

3) Transportation

Environmental issues:
- Transporting raw materials and the **finished case** will release emissions which can damage the environment.
- Use of different transport types (ships, trucks, trains) will have different amounts of emissions.

4) Product use

Use:
- The product is carried around and used at shows and meetings as well at home one their own projects

Environmental issues:
- There are no environmental issues with using the product as it is a stable structure which does not release anything when being used. (other than it being transported around.

5) End of life

Options:
- Landfill
- Incineration (burning)
- Recycling

Environmental issues:
- In landfill the MDF can release methane which is a harmful pollutant to the atmosphere
- Burning MDF can release dangerous and harmful chemicals if done incorrectly
- Recycling can be difficult (due to the resin) and will not be available everywhere.

Summary and next steps:
I have looked into the impact of the product on the environment and how it can be minimised. Next I will look into the marketing and the different considerations that need to be made to best market it.

Marketing

Logo

The logo is very clear and simple making it obvious to the consumer that is a simple product.

The name of it (stow case) makes it clear what the product does (stores and organises things). With the name being paired with a box makes it even more obvious that is it for storage.

Packaging

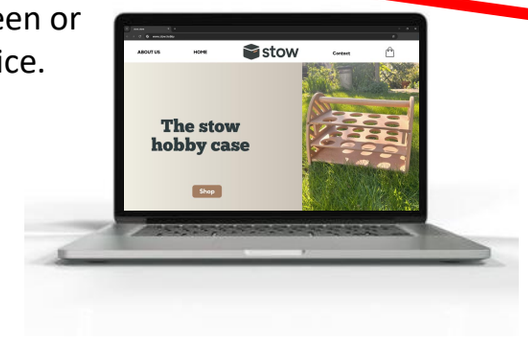
The clear and simple logo can be printed onto the delivery box. This gives the box and the service more link and allows the brands identity to be shown.

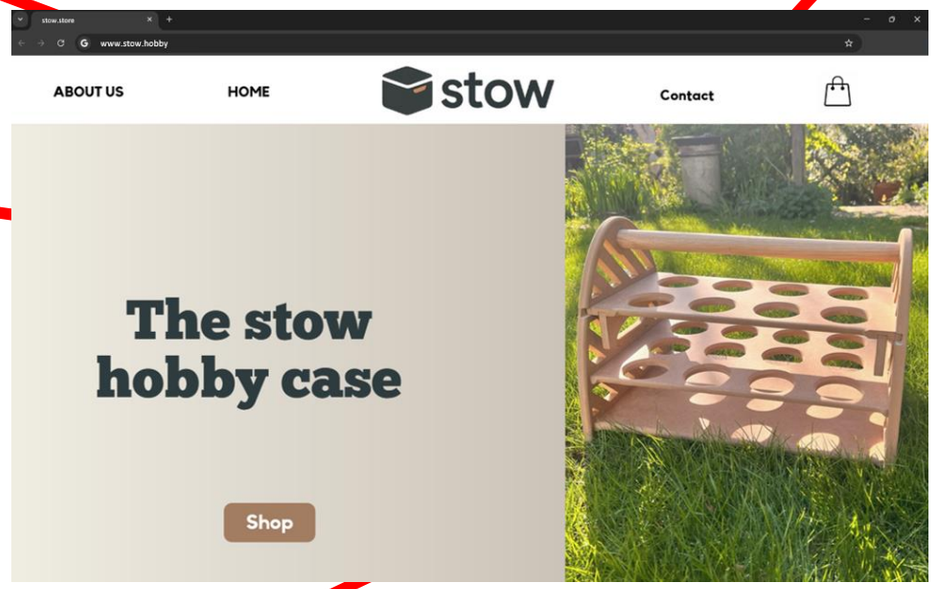
Icons/imagery should also be added to the box to give instructions of how to handle the product when delivering it. These should include:

- Warning of the weight
- Correct lifting positions
- Sharp edges (of the box)

Website render

This shows how the website could look on a laptop screen or another device.





The website is a simple design with clear images of the product and a simple and clear UI.

Marketing considerations

<u>USP:</u>
The USP of the case is with the storage type and the function of the trays. This could be made clearer in the website with images of the top tray separate and with the pots in the holes.

<u>Customer experience:</u>
The customer needs to have an enjoyable and easy time on the website. This means the are more likely to buy more, return in the future, or recommend to others. This will allow the brand awareness and userbase to grow allowing the product to become more popular.

<u>Target audience:</u>
The website and marketing should be biased towards the end users and target market, as it will be where the maximum amounts of profit and sales will come from. The target market includes hobbyists, craft/DIY enthusiasts and event/show (model/miniature shows) goers.

<u>Price point:</u>
The price of the case needs to be high enough to cover the cost taken to make as well as making a sustainable profit. But the cost should also be kept as low as possible to allow more people to afford it and also to keeps the market interested in it.

<u>Summary and next steps:</u>
I have looked into the steps involved in marketing and how best to show off my brand and product.