

D.T. Major Project

All In One Portable Soldering Station/Kit



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Problem and problem confirmation

People who build their own circuits (hobbyists and electricians) often have to buy their own tools separately, this causes confusion as to what to purchase and therefore a higher total cost.

These people also have troubles with inadequate space and damaged surfaces due to human errors. Often people who are "on the go" tend to forget some of their tools or essential parts of their tools. This causes issues and leads to incomplete work later on.

After considering the problems faced by hobbyists and electricians I thought of solving their problem by designing and providing them with a tool box or a bag in which they could store the tools needed. However I was then told that they tend to damage the surface they are working on and so I thought of designing and making an All-in-one portable soldering station.

This soldering station would be sold as a kit which would be self contained in a briefcase. This would include the soldering essentials such as the soldering iron, solder roll, helping hands, fume extractor etcetera. This kit would be modular so that its component can be taken apart and put back together allowing maximum flexibility to its users.

To ensure there is a market available for such a product I conducted various surveys online and at different R&D departments of different firms. I noticed people usually face problems with their workspace and often end up damaging their table tops due to human errors. They also notified me about them forgetting their tools at different locations. People also found it difficult to working around to pack up the tools specially the wired ones. This caused them to dump them in their bag which often led to damaged tools.

Design brief

Criteria A – Analysis of a design opportunity

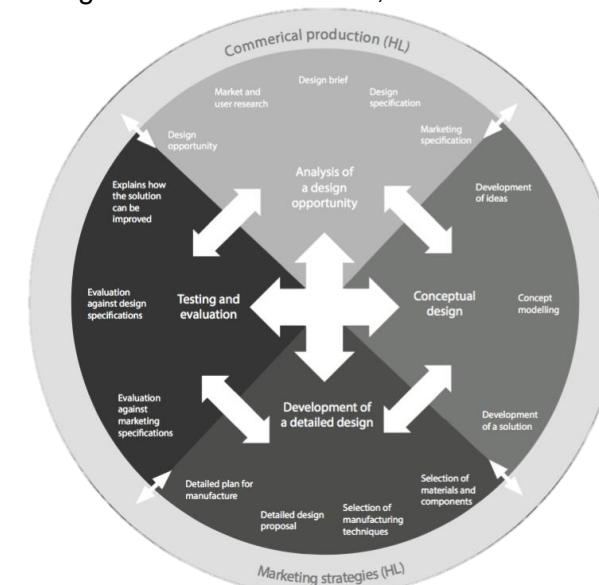
I will be designing and making an All-in-One portable soldering station that will cater to various markets such as hobbyists and technological firms as well.

My aim is to create such a product that makes it easier for people to solder anywhere they want. The proposed product will have all the essential soldering tools such as the iron, extraction and helping hands.

The product should not have any redundant or unnecessary tools that may not be used. It should also be as light and portable as possible, while still giving as much functionality as possible.

The tools used should be modular as well in the sense that if they are not wanted by the user, they can be taken apart from the product, leaving the user with extra space that could be used for any other tools they might want or of a specific brand.

I will be following the design cycle to proceed with my design, starting from analysis of a design opportunity followed by conceptualization on designs then proceeding to development of a detailed design which is then tested, evaluated and marketed.



Market Research

Criteria A – Analysis of
a design opportunity

I conducted an online survey that anyone interested could answer. I did this survey to prove that there is a market for the product and that it is commercially viable. Even though I personally feel that my proposed product would be better sold to technology firms that require manual soldering specially in their R&D units. As I have noticed at the company I was interning that the people who solder are always on the go and regularly experience inadequate workspace.

From the research I conducted, I realised that out of every ten people surveyed, seven of them did face various problems while soldering. Most of the surveyed people reported that lack of space is a major problem they face and would certainly consider buying such a product that I proposed.

I also posted a question on the ARDUINO FORUMS giving a brief as to what I expect them to answer about. I asked about what tools would be considered necessary for soldering, the answers varied because they were very subjective. There were also a few tools that are not necessary for soldering but would be a good addition to the product such as a fume extractor/exhaust.

Since my design is a self contained one, there is no need of measuring different tools sizes and averaging them to make a product that fits all. Rather my product will have all the necessary tools. In order to make this a worth buying product, I will personally choose the tools to use so that the users get the best tools for the lowest possible price.

I also researched about different soldering irons and their compatible tools. I looked at various brands such as HAKKO, WELLER, TRADEFLAME, AOYUE. I realised that these brands offer extremely good products but the products came with a hefty price tag pinned to it. So I chose to go for the most affordable HAKKO 936 soldering station and iron. The station and iron together costed 40\$ (USD) and other add-on accessories upped the total cost to a sum of 60\$ (USD). While observing people I also realised that when they open up any device, they tend to misplace the fasteners and screws, so I felt adding a strip of magnet could help the screws and fasteners to stay in place.

The links to the forum and surveys are:

<http://goo.gl/forms/zx6qES8tEW>

<http://goo.gl/forms/2vJ2458LXO>

<http://forum.arduino.cc/index.php?topic=308735.0:topicseen>

Topic: tools you'd use (Read 858 times)

Previous Topic – Next Topic

adityasehgal

Newbie Posts: 6 Karma: 0 [add] IP: 122.161.246.161

tools you'd use Mar 16, 2015, 03:27 pm

hey! this is for a school pject so i need an answer, i was thinking of making an all in one soldering kit which is portbale. so it would have everything from the soldering iron to an exhaust... all the soldering essentails needed. so i wanted to know if you guys would be interested in buying it so that i can determine if its commercially viable or not. also any suggestions/tips are welcome 😊 (Y)

Report to moderator

weedpharma

Faraday Member Posts: 3,243 Karma: 754 [add] IP: Logged

Re: tools you'd use Mar 17, 2015, 01:44 am #1

Many of the members here are long into electronics and would have their own tools already. I personally would not buy a kit as I have my preferences as to what I want.

There is a fine line between what is essential and what is excess in tool kits. An extractor may be nice but it is not essential for the cost involved. Especially for beginners.

Your experience in electronics would probably not be sufficient to know what are good or bad tools. I would not use cheap tools. The tools I use would be well beyond the affordability of a student!

TomGeorge

Faraday Member Posts: 5,682 Karma: 206 [add] IP: Logged

Electronics Engineer/Industrial Control

Re: tools you'd use Mar 17, 2015, 07:10 am #2

Hi,
Desoldering Braid...<http://www.radioshack.com/desoldering-braid/6402090.html#.VQfSWo6Udv8>

Tip Cleaner...<https://www.sparkfun.com/products/8966>

Solder Roll.....<http://uk.rs-online.com/web/p/solders/0551665/>

Tom..... 😊

Report to moderator

Everything runs on smoke, let the smoke out, it stops running...

weedpharma

Faraday Member Posts: 3,243 Karma: 754 [add] IP: Logged

Re: tools you'd use Mar 17, 2015, 07:26 am Last Edit: Mar 17, 2015, 11:23 am by weedpharma #3

Temperature controlled soldering iron.

Sharp side cutters. (For Electronics, not electrical)

Small tip pliers

Isopropyl for cleaning off flux.

Soldering is one of the black arts that takes practice to do correctly. Get some old circuit boards and practice removing and replacing the components.

One of the main problems is the time the tip is in contact with the job. Too much time and you risk over heating the component or damaging the board. Too little time and you end up with a "dry joint" where the solder does not melt

Survey

All in one portable soldering station

Soldering is a common joining technique used in manufacture of circuit boards and electronics. It is a similar technique to 'spot welding' and 'brazing' where a metal alloy is used to fuse two surfaces typically of the same metal. Soldering is the alloy used to fuse and it generally made of Tin (60%) and Lead (40%). But soldering is done with various other metals such as Gold and Silver which are used when a circuit with extremely low resistance is required.

This survey is conducted for a Design and Technology project where I will be designing and making a soldering station in a briefcase. This would be portable so that it can be carried anywhere and everywhere and would be self contained with all the essential tools and accessories used while soldering.

Your responses will be collated and analysed to design the best soldering station which would have only the necessary tools that would be helpful for everyone whether a professional or a beginner. This station will be designed according to what the potential market wants, so describing your desired product would yield in the best designs.

* Required

1. How old are you? *

Mark only one oval.

- Under 15
- 16-20
- 20-25
- 25-30
- Above 30

2. What affects your perception of any product? *

Check all that apply.

- Color
- Aesthetics
- Ergonomics
- Functionality
- Eco-friendliness
- Cost
- Brand
- Other: _____

3. What colors do you like to see in a product? *

4. Do you know about soldering? *

Mark only one oval.

- No
- Yes

5. How often do you use the soldering tools? *

Mark only one oval.

- I don't use any soldering tools
- Once a week
- 2-3 times a week
- 4-5 times a week
- More than 6 times a week

6. Why do you use soldering tools? *

Check all that apply.

- Hobby
- Profession
- Just for fun
- I don't use soldering tools

7. What all tools do you consider buying when looking for soldering tools? *

Check all that apply.

- Iron
- Solder
- Flux
- Wire Strippers
- Helping Hands
- Magnifying Glass
- Fume Extractor
- Schematic Holder
- Tool Manager
- Back Lighting
- Other: _____

8. What problems do you face while soldering? *

Problems such as lack of space, forgetting tools at places, etc.

9. Would you like to learn more about soldering? *

Mark only one oval.

- Yes
- No

10. Would you consider buying an All in one portable soldering station? *

Mark only one oval.

- Yes
- Maybe
- No

11. How much would you be willing to spend on an All in one portable soldering station? *

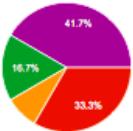
Mark only one oval.

- 1-3000 Rs
- 3001-6000 Rs
- 6001-9000 Rs
- 9001-15000 Rs
- Above 15000 Rs

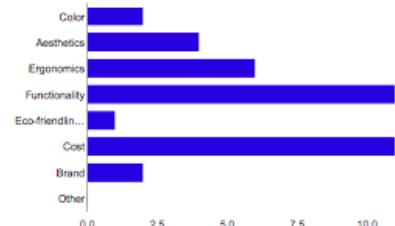
12. Other feedback

Summary

How old are you?



What affects your perception of any product?



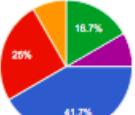
Color	2	16.7%
Aesthetics	4	33.3%
Ergonomics	6	50%
Functionality	11	91.7%
Eco-friendliness	1	8.3%
Cost	11	91.7%
Brand	2	16.7%

What colors do you like to see in a product?

Black
black and white
Red and white
I like to see a constant theme like light blue with white and accents of black
Any, all
blue
I like to see purple, pink, blue, green, and orange. Really saturated hues, whenever possible.
red
colour should be black or grey something like that I like
I dont have a preference
blue white

Survey Results

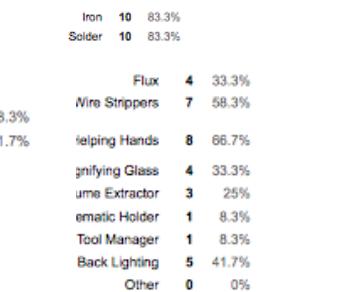
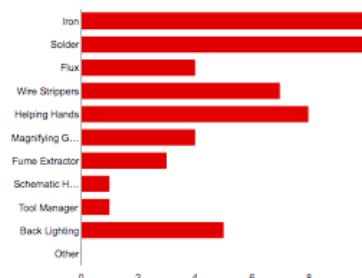
Do you use the soldering tools?



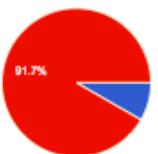
Why do you use soldering tools?



What all tools do you consider buying when looking for soldering tools?



Do you know about soldering?



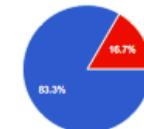
What problems do you face while soldering?

none
A proper solder holder is often missing.
Cord getting in the way.
lack of space
managing tools at the workplace is tough
I don't solder, myself. But my friends who do tend to have postural complaints, a lot of neck pain and headaches. It's an ergonomic issue. Oh, and lack of space.
I usually dont have much space to work in and the wires keep coming in my way. i also keep forgetting my tools at places
Space around me
carrying tools is a pain
soldering in a small spaces creates problem.
Lack of space

Criteria A – Analysis of a design opportunity

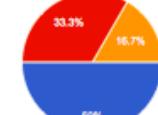
Yes	10	83.3%
No	2	16.7%

Would you like to learn more about soldering?

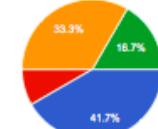
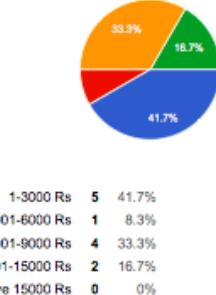


Would you consider buying an All in one portable soldering station?

Yes	6	50%
Maybe	4	33.3%
No	2	16.7%



How much would you be willing to spend on an All in one portable soldering station?



Other feedback

Hopefully there's work being done regarding the physical complaints resulting from soldering a lot!

Research Results

Criteria A – Analysis of
a design opportunity

All-in-one Soldering Kit

* Required

1. How often do you use your soldering tools? *

how often do you solder in a week

Mark only one oval.

- once a week
- 2-3 times a week
- 4-5 times a week
- more than six times

2. Do you face any problems while soldering? *

While soldering, do you face any problems with the space or the tools you would use?

Mark only one oval.

- Yes
- No

3. What problems do you face? (If any)

If there are no problems faced, skip this question. Multiple options may be selected.

Check all that apply.

- Lack of space
- Tools don't stay in place
- Tough to choose the right tools
- Tough to carry the tools
- Other

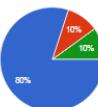
4. Would you be interested in buying a portable soldering tool kit? *

The tool kit would have all the soldering essentials and it would also be acting as a portable work station.

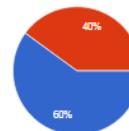
Mark only one oval.

- Yes
- No

How often do you use your soldering tools?

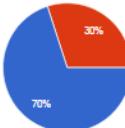


Would you be interested in buying a portable soldering tool kit?

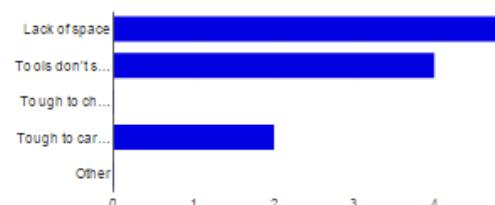


Yes 6 60%
No 4 40%

Do you face any problems while soldering?



What problems do you face? (If any)



Lack of space 5 71.4%
Tools don't stay in place 4 57.1%
Tough to choose the right tools 0 0%
Tough to carry the tools 2 28.6%
Other 0 0%

Analysis of the research was done to help me determine consumer specifications which would help me set suitable product specifications to design the best product. By having pre-determined consumer specification, I would know what the consumers are expecting from such a product also known as market oriented products. By having product specifications, by the end of the process, I will be able to match my product to its specifications to determine whether it was a successful design or not and also suggest possible improvements.

By analysing the data, I realised that most people do face problems while soldering which would be very common problems such as lack of space and that tools don't stay in place. I also got to know that most people would want a colour scheme of black and white and that most people are willing to pay anywhere from 6000 to 9000 Indian Rupees which provides me a good budget for which I will have to outsource the best prices for the best tools and incorporate the most cost effective production methods.

Existing Designs



Existing Product Analysis



Pros	Cons
<ul style="list-style-type: none"> Very organized Has dedicated holder for solder spools Has dedicated place for all the different tools 	<ul style="list-style-type: none"> Not portable Uses the workplace to be stationed at, thus decreasing available area to work in Does not have dedicated work area

Form	<ul style="list-style-type: none"> Simple layer style form, with three layers, two for hand tools (pliers, wire cutters) one for stationary tools (soldering station). Top layer has a rack extruded to hang tweezers used for SMD circuits.
Function	<ul style="list-style-type: none"> Holder for solder wire is present to ease the soldering process. Stores all necessary tools Specialized location for some tools such as tweezers make it easier to access. Makes it easier to sort everything.
Ergonomics	<ul style="list-style-type: none"> Solder holder helps with easy access to the solder wire. The tweezers rack also increases space available for work and increases accessibility.
Safety	<ul style="list-style-type: none"> Provides no safety as all tools are open and can hurt the user. No protection for tools.
Materials	<ul style="list-style-type: none"> The plastic used for the platforms seems to be abs. The rods that elevate the platforms could either be stainless steel or aluminum. There are also rubber feet used to prevent it from slipping on the surfaces.

Existing Product Analysis



Pros	Cons
<ul style="list-style-type: none"> Very portable Has sufficient space to add whatever tools the user wants to add There is easy access to the top compartment 	<ul style="list-style-type: none"> Not as organized, as there is no dedicated slots/area for different tools It is made out of wood, which is rather dense and not waterproof unless treated Does not have dedicated workplace that can be used by a consumer

Form	<ul style="list-style-type: none"> Seems portable. Has two platforms. One platform is also a container for the wire spools and other tools.
Function	<ul style="list-style-type: none"> Stores all tools required. Opens up using a latch and dismantles into two storage units. Has dedicated holes for wire to be pulled out of.
Ergonomics	<ul style="list-style-type: none"> Has a handle on the top for portability. Does not use much space – as big as a general tools box.
Safety	<ul style="list-style-type: none"> Tools are not openly exposed, increasing safety Does have sharp corners which can poke and bruise the user.
Materials	<ul style="list-style-type: none"> The entire product is made of wood, likely to be balsa The latches are outsourced and could me made out of steel The wood is likely to burn if contact is made with the iron

Existing Product Analysis



Pros	Cons
<ul style="list-style-type: none"> Very organized Very portable Has dedicated slots for the tools Protects tools from harsh conditions 	<ul style="list-style-type: none"> Does not have a dedicated workplace that can be used by a consumer Does not have space for any extra tools that users may want to add

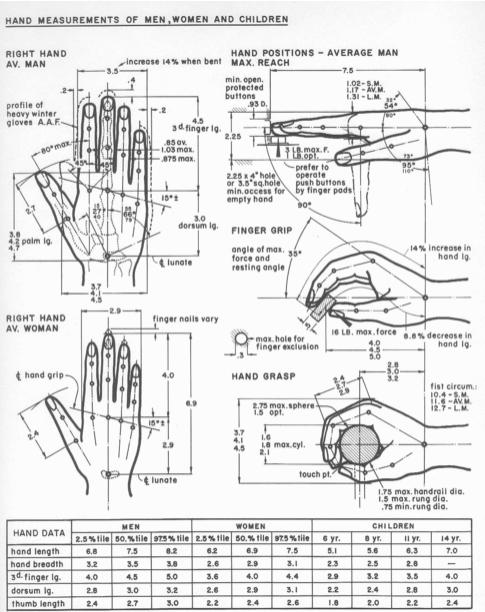
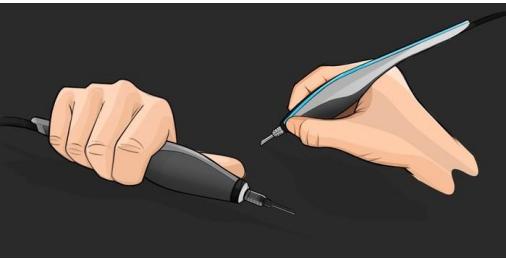
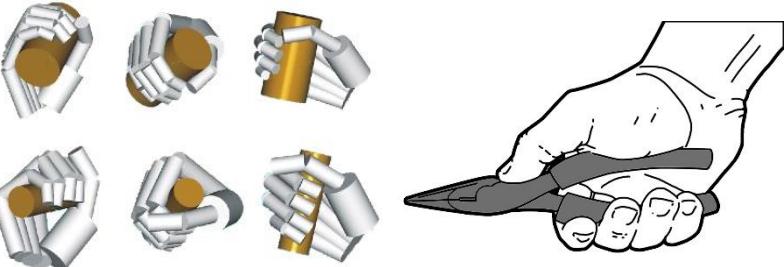
Form	<ul style="list-style-type: none"> Seems portable. Built like a briefcase.
Function	<ul style="list-style-type: none"> Stores all tools required. Opens up using a latch. Keeps everything compact and in reach.
Ergonomics	<ul style="list-style-type: none"> Has a handle on the top for portability. Does not use much space.
Safety	<ul style="list-style-type: none"> Tools are not openly exposed, increasing safety. Can not stand vertically, making it prone to tipping over.
Materials	<ul style="list-style-type: none"> The product is made of plastics like ABS.

Product Specifications



Requirement	Specification
Aesthetic Requirements	Not very important, but should look robust and strong
Cost Constraints	Since it will replace buying a table, tools and storage, consumers should be willing to pay more than a regular storage box
Customer Requirements	should have enough storage and should be able to be used in most places possible
Environmental Requirements	should not harm the environment when being produced, and should be able to filter the solder fumes
Size Constraints	should not be too big as it is supposed to be portable, but should also not be so small that working on it gets difficult
Safety Considerations	Should not have sharp edges and should has safety measures taken into account for tools like the soldering iron that get hot
Performance Requirements & Constraints	should be able to be used easily with minimal construction and should be easy to maintain
Materials Requirements	materials used should be resistant to heat and not deform or break under stress
Manufacturing Requirements	should be easy to manufacture with either additive techniques used or forming techniques used to reduce waste

Sizes of Products



The product sizes ideally should vary according to the users ergonomics, but because it is not possible to make a fully customized product every time for each different user, designers, design a standardized product that should be similar to “one size fits all” clothing concept.

These sizes are determined by studying ergonomics in both static and dynamic states so that the measured sizes can be average to fill all percentile groups from 5th to 95th percentile. This percentile range should ideally cover all sizes and thus make products that anybody can use with ease.

In this project, the hand sizes will be the focus as tools are mostly held and operated by hands.

Ergonomics



After studying about ergonomics, I narrowed down to the study of the human hand as the hand would be the body part that will be interacting with the product.

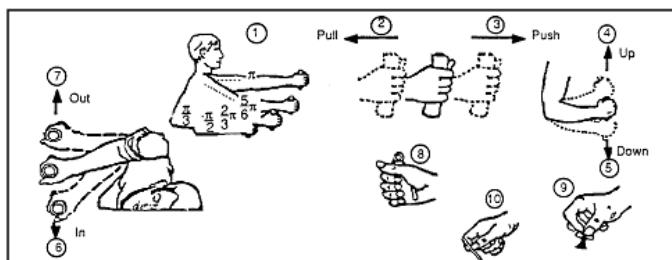
Since the contents would make the overall product heavy, the handle of the briefcase should be designed in such a way that it feels soft to touch and also takes the natural shape of an average grip.

The tools that will be supplied with the product would be outsourced, but some modifications maybe made such as adding a more natural feeling handle to the soldering iron.

The outer shell of the product would be made according to the natural reach of a person sitting at a table. This would be done to make the product not overly large neither make it too small. But it should be sized well enough to give the user enough workspace to prevent using space outside of the case.

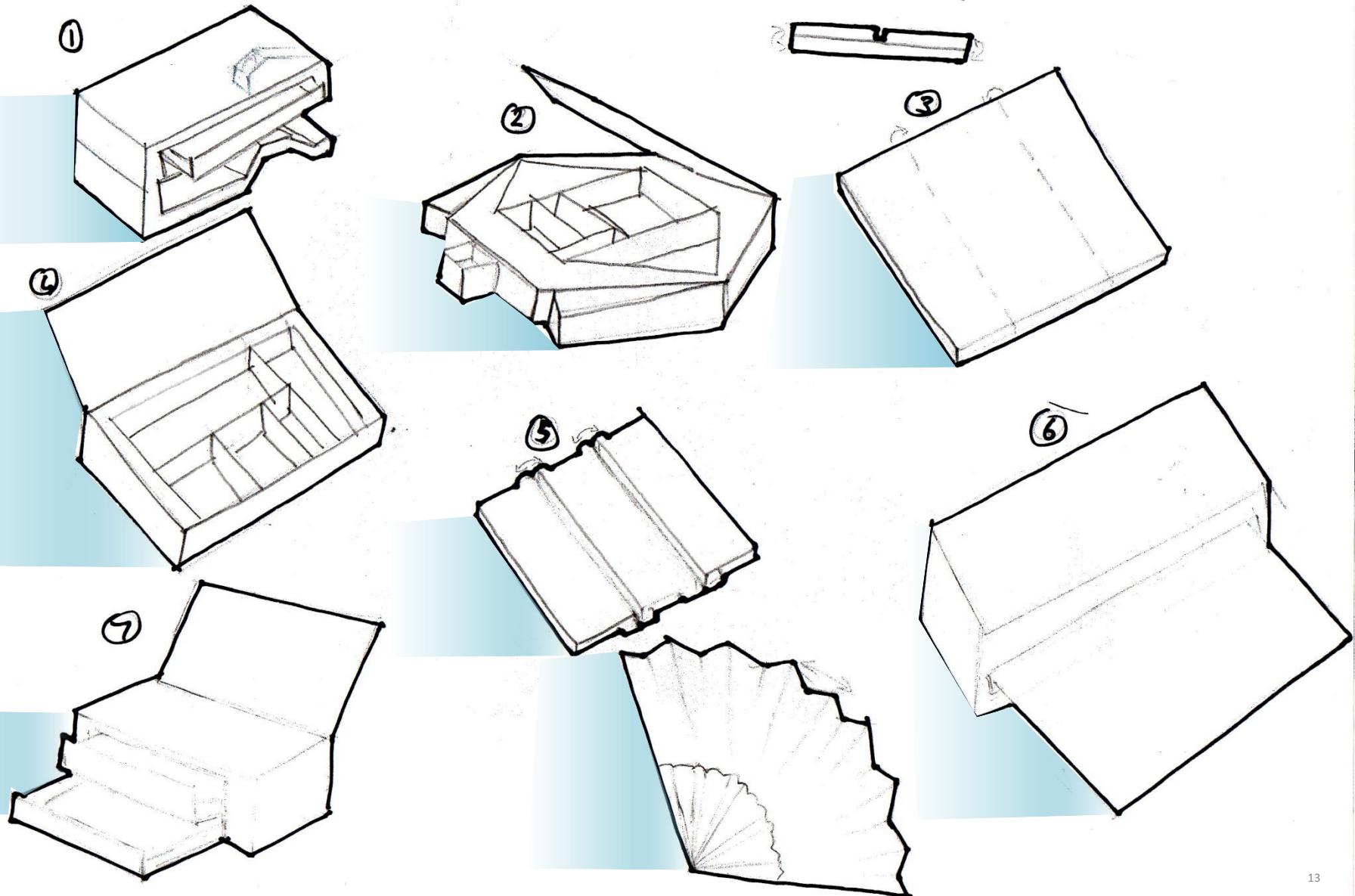
The base of the case that would be the soldering surface, should not be too elevated because the case itself would be placed on top of a table, so that would elevate it enough. If the base is too much elevated, the users will find it very difficult to operate the tools as they would end up being closer to the users face. This would restrict motion of hands.

The tool handles will be redesigned keeping in mind both, static and dynamic states of the human hand. I will also be considering the natural grip of an average hand to provide maximum amount of comfort and the best grip possible.



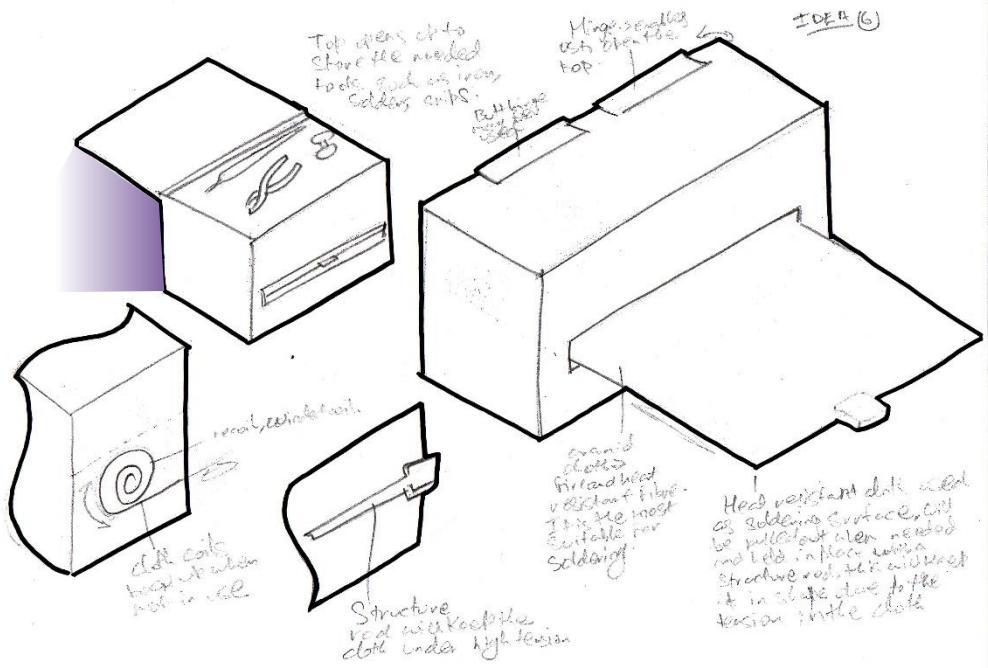
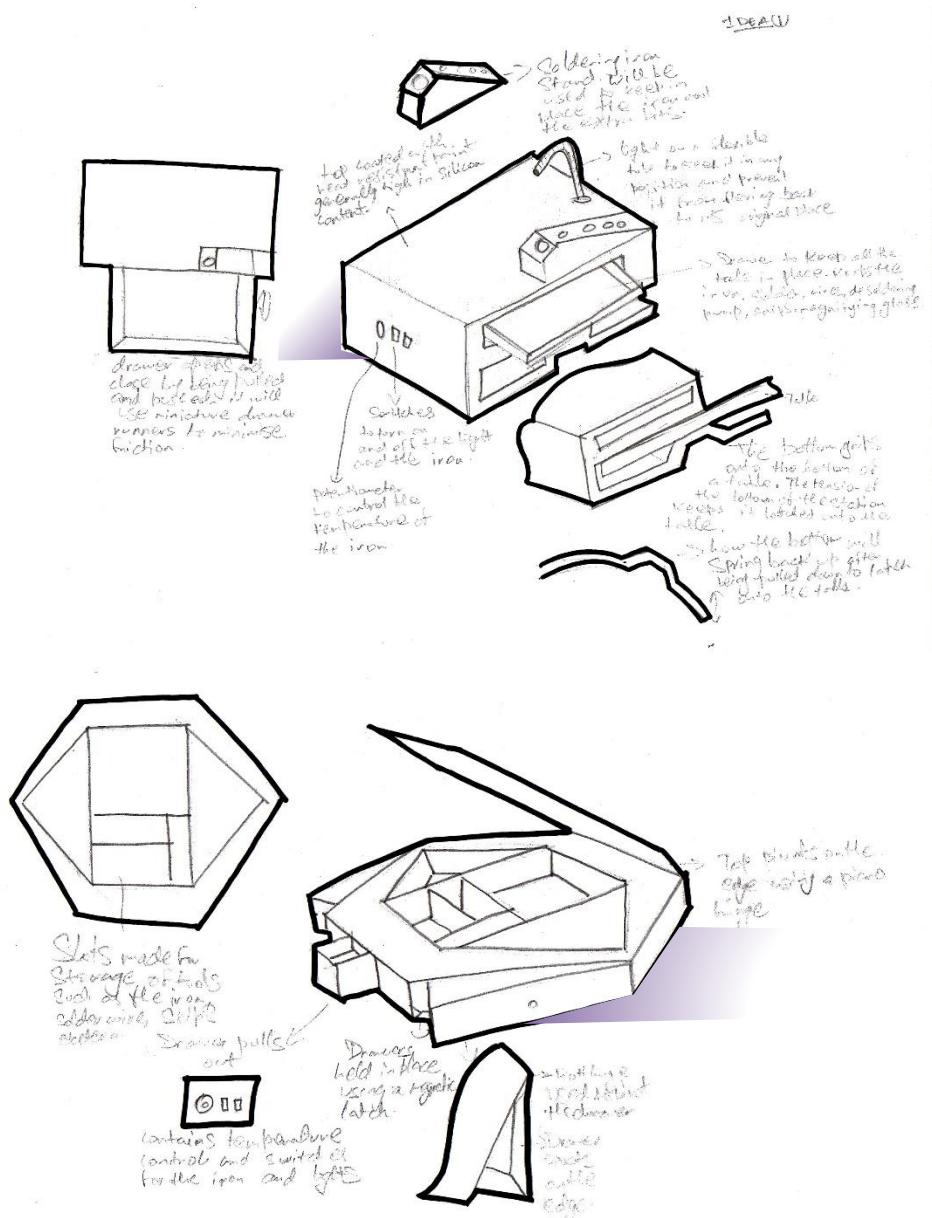
Initial Ideas

Criteria B – Conceptual design



Development of three ideas

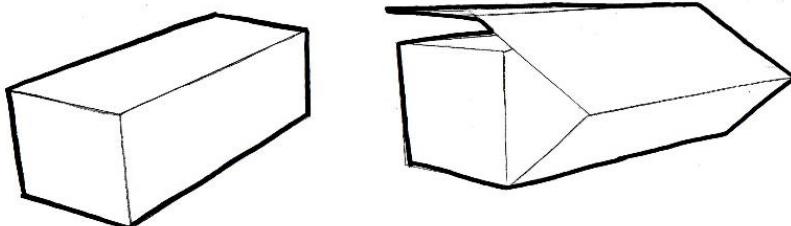
Criteria B – Conceptual design



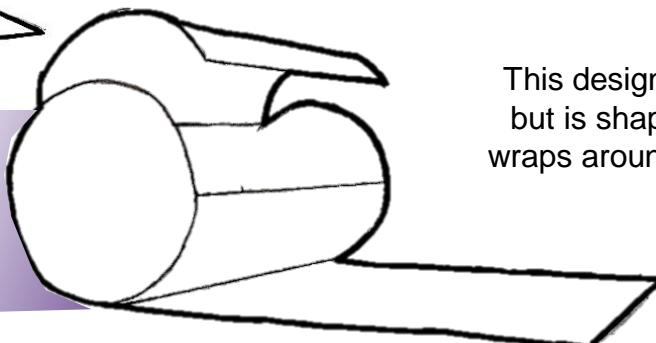
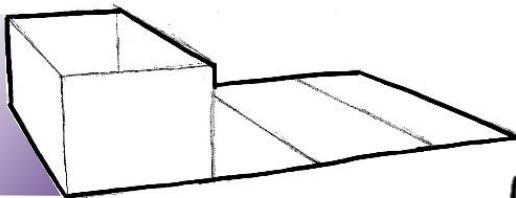
These three have been chosen because they seem to be the most versatile as they all can be easily transported and used as well. They all offer convenient storage that should be adequate for 'on the go jobs'. From these three, I will be coming up with another design that should be mixture of these three designs, taking some elements form each design, such as the shape of design 2, and the roll back action work area from design 6.

Development one final idea – Combining Previous Designs

Criteria B – Conceptual design

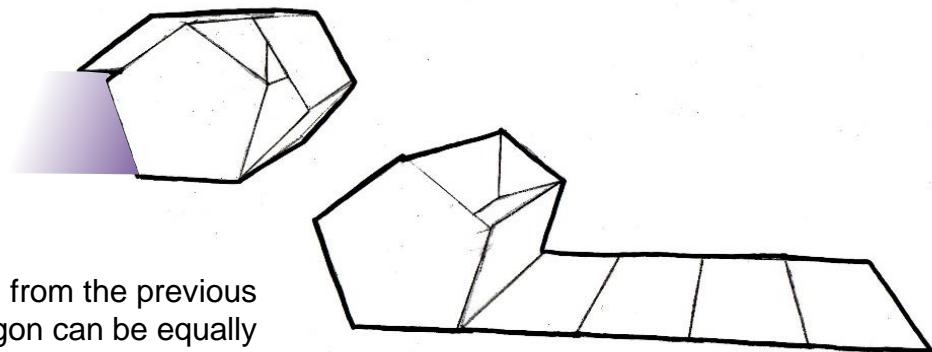
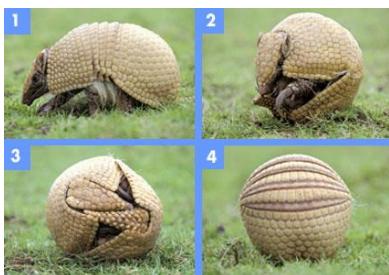


This design has been inspired from design 6 and 2. The shape is a simple cuboid with a flap that rolls around it to encompass the cuboid, this works as a cover and a workplace as well.



This design has been inspired from the previous but is shaped as a cylinder. The work area also wraps around the main body of the product to help the product stay shut.

All these designs work just like an armadillo, the product wraps around itself.



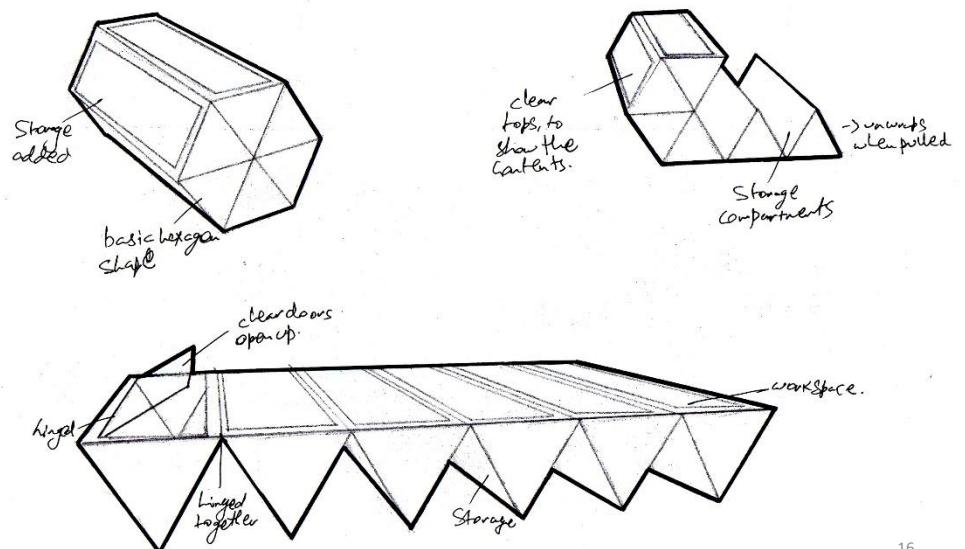
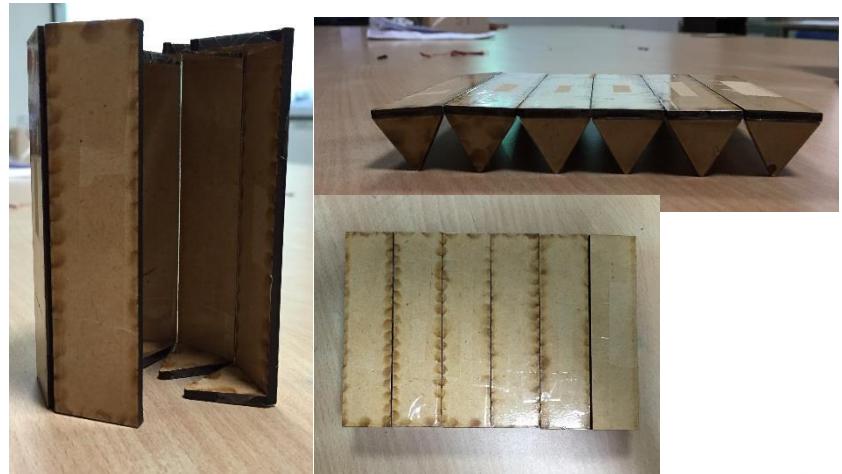
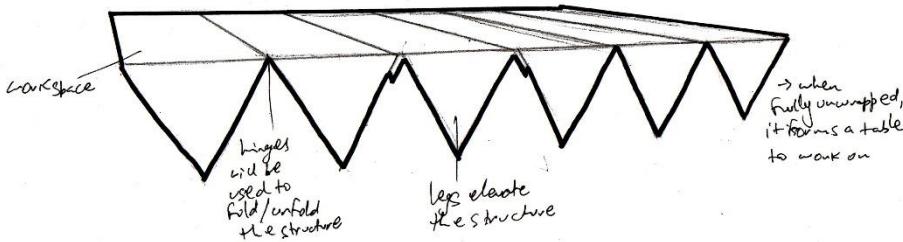
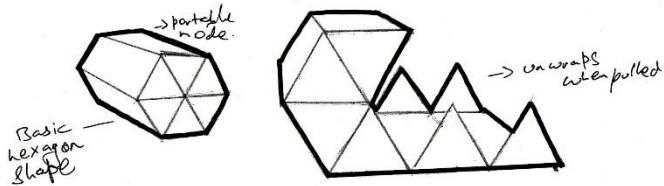
This design has been inspired from the previous but is a pentagon, as a pentagon can be equally divided into sectors for easy management and storage. This also has a flap that rolls around the core and can also be used as a work area.

Development of one final idea

Criteria C –
development of a
detailed design

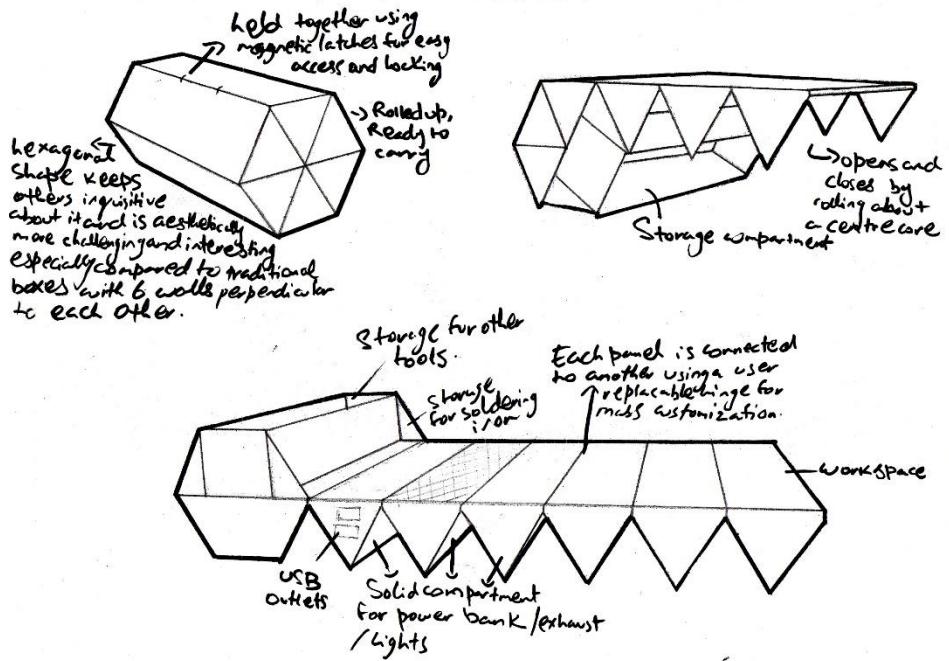
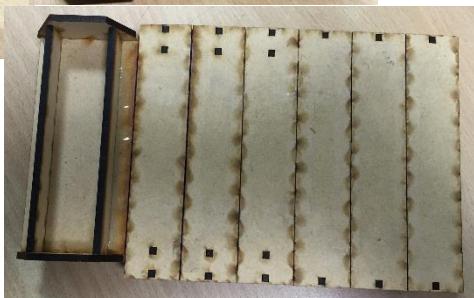
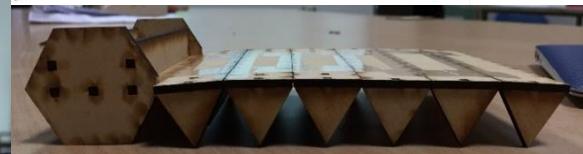
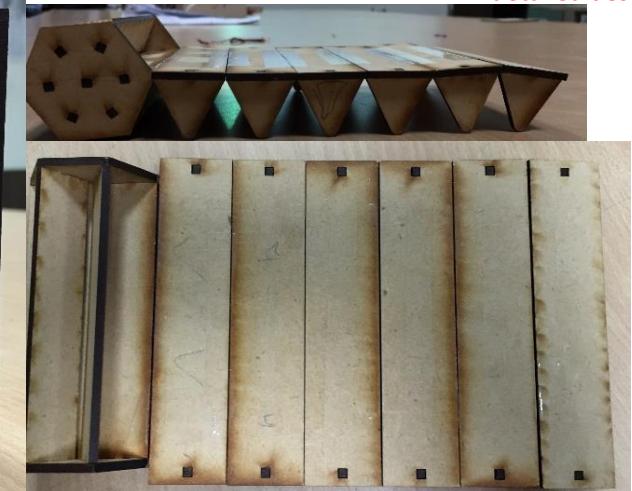
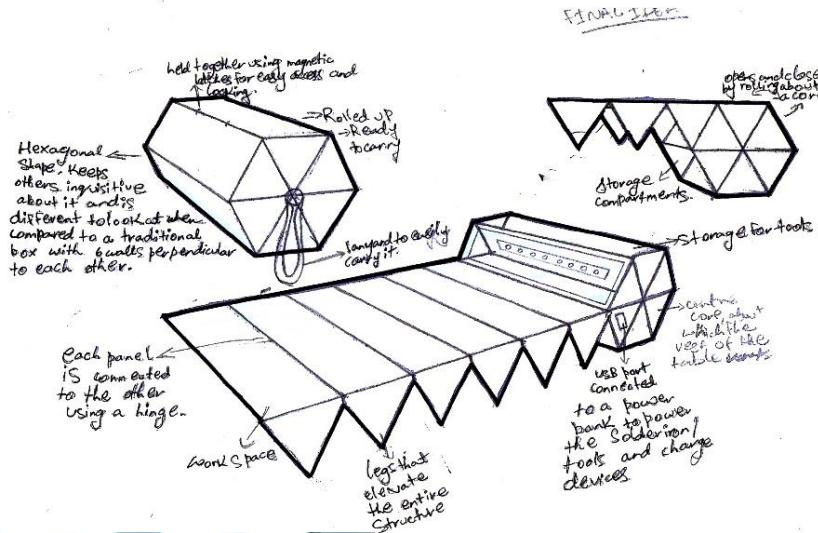
For the final product, I have decided the use the hexagonal shape, the roll back work area and easy storage from the previously developed ideas.

In the followings designs, I have majorly improved the storage space, as it is one of the most important factors to consider for such product that should be easy to transport as well.



Development of one final idea

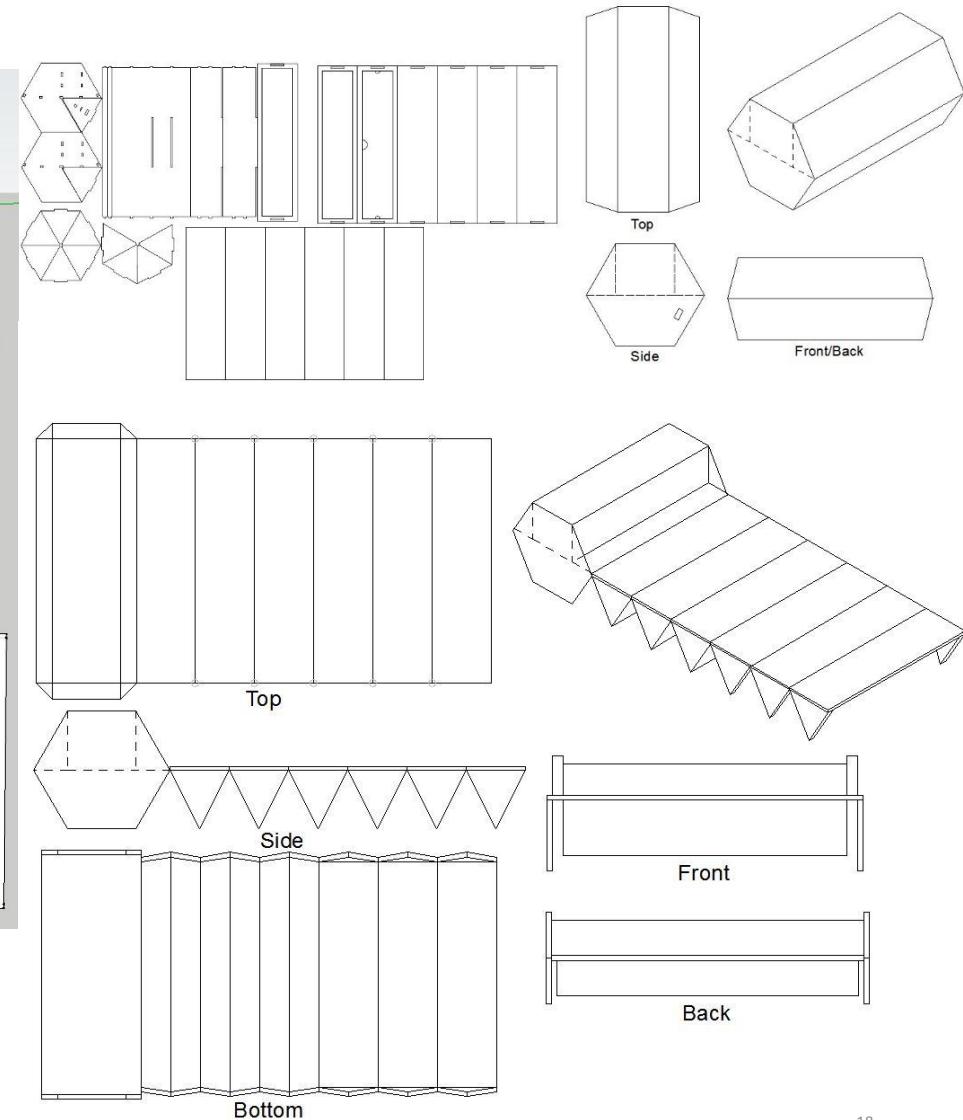
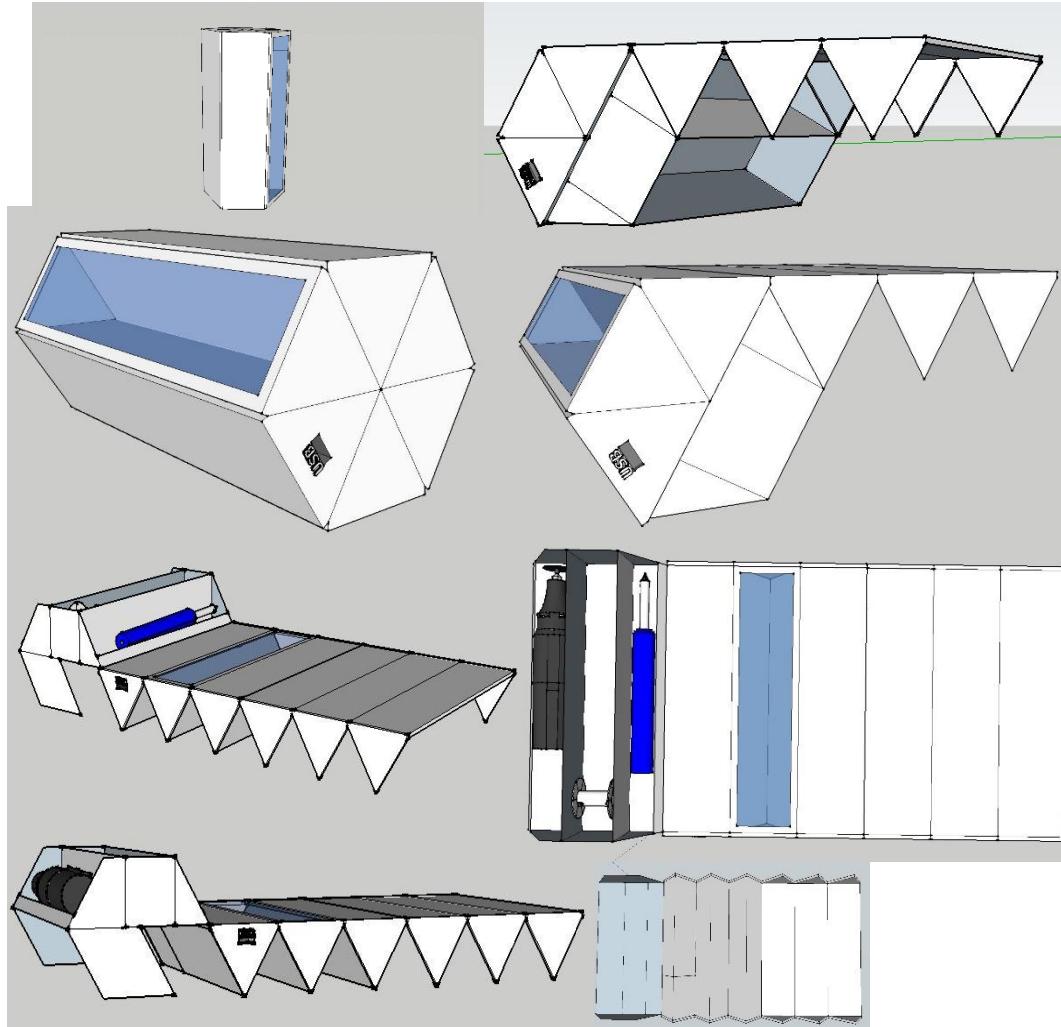
Criteria C –
development of a
detailed design



Designing the final idea to manufacture

Criteria C –
development of a
detailed design

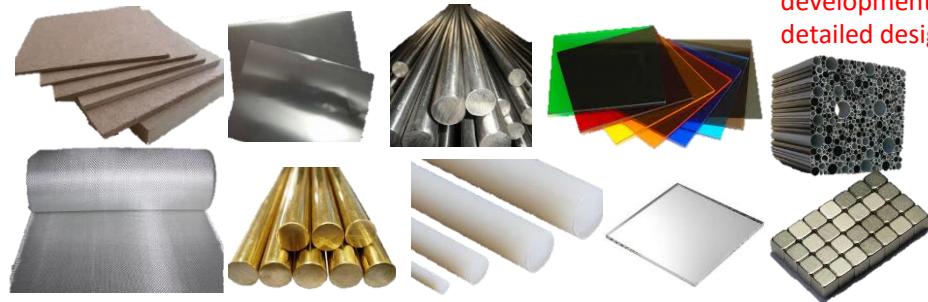
The final design represented in the last slide is the one I will be producing to test, and then market. It seems to be the best fit as it is very portable, stores all the necessary tools including an internal battery and customizable storage tubes.



Manufacturing Techniques

Technique	Pros	Cons
Laser Cutting	<ul style="list-style-type: none"> Fast Easy Cheap Uses CAD 	<ul style="list-style-type: none"> Produces harmful fumes Can only work in 2-D Uses a lot of power in operating
3-D Printing	<ul style="list-style-type: none"> Quick Can make 3-d shapes from scratch Easy Uses CAD 	<ul style="list-style-type: none"> Very expensive Limited size range Limited materials Can not do the internals
Lathe	<ul style="list-style-type: none"> Can be used for a number of materials Produces very detailed work Round shapes can be worked on 	<ul style="list-style-type: none"> Requires human attention during operation Can only be used with round objects Time taking
Soldering	<ul style="list-style-type: none"> Securely bonds the connections Give good conductivity 	<ul style="list-style-type: none"> Releases harmful fumes Time taking Contains lead Requires human attention
Vacuum Forming	<ul style="list-style-type: none"> Quick Easy Cheap Gives precise details of the used mould Helps in repetition 	<ul style="list-style-type: none"> Requires a mould Can only do the outer shell Material thins out as it is formed Limited materials
Injection moulding	<ul style="list-style-type: none"> Quick Easy Produces that same product every time Helps in monotonous production 	<ul style="list-style-type: none"> Requires different mould for different shape Can only form plastics Can not produce chamfered products like bottles

Material Selection



Criteria C – development of a detailed design

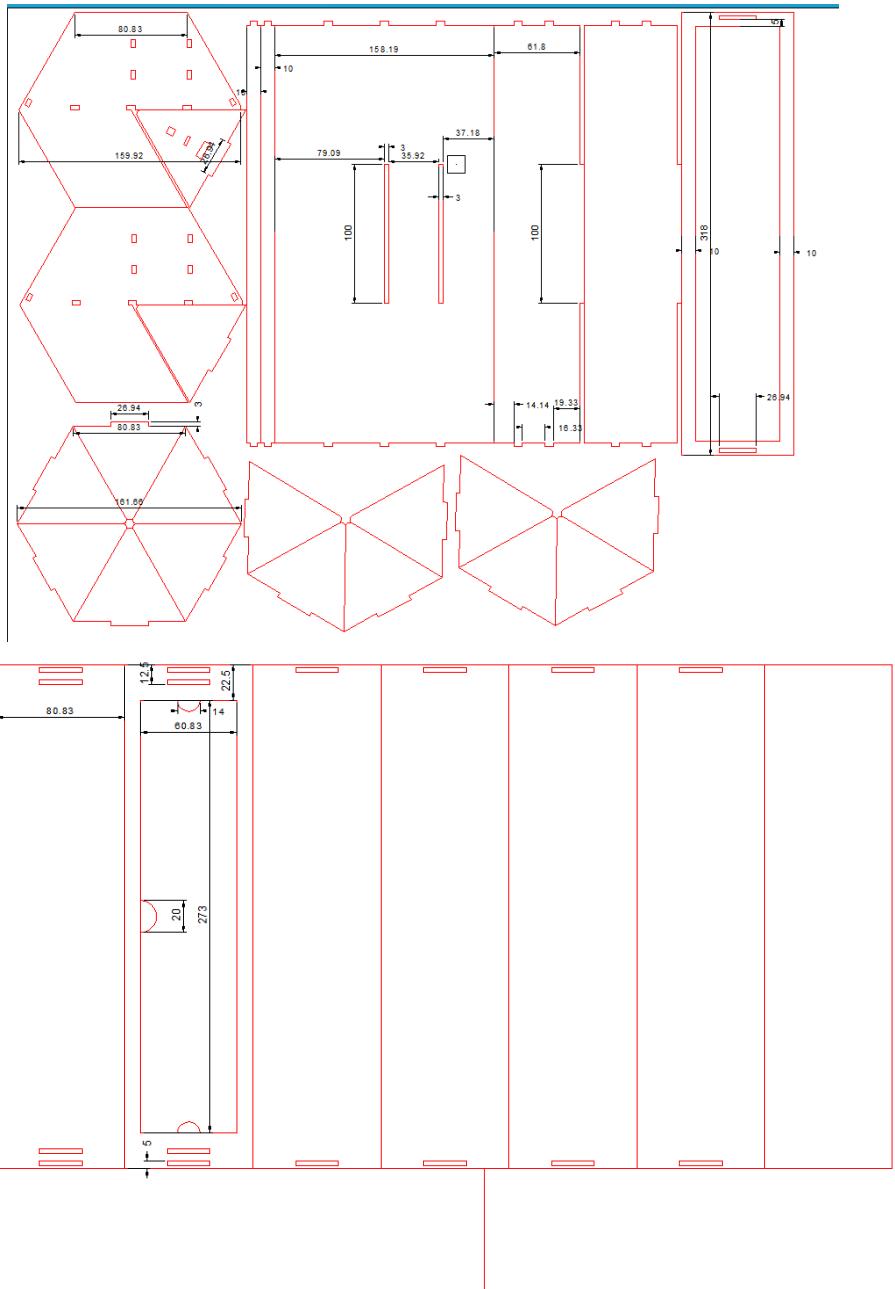
Material	Density	Ease of manipulation	Thermal Resistivity	Electrical Conductivity
MDF	Medium	Easy	High	Low
Aluminium	Low	Medium	Low	High
Steel	High	Hard	Low	High
Acrylic	Low/Medium	Easy	High	Low
PVC	Medium	Easy	High	Low
Glass Fibre	Low	Medium	High	Low
Brass	High	Hard	Low	High
Nylon	Medium	Easy	High	Low
Glass	High	Hard	High	Low
Neodymium	High	Hard	High	Medium
ABS	Medium	Medium	High	Low

After analysing multiple materials and their properties, I have concluded to using certain materials for certain parts of my proposed product. ABS will be used as it can be easily injection moulded once the mould is determined and also has a very low thermal and electrical conductivity. But due to lack of materials, the product will be made using laser cut MDF in school as it is readily available.

Brass could be used for hinges as it has frictional properties due to which the outer shell will stay in place, but due to time constraints, fabric will be glued to the sections to make a hinge.

Production

Criteria C –
development of a
detailed design



The design will be produced in the school workshop by me, mainly using the laser cutter and 2D Design software, provided by TechSoft. The images on the left show the different components of the product with their actual measurements in mm.

The different components will slot into each other using the finger joints, and then glued together using PVA glue to keep the product together.

The different tubes that form the table will be hinged together using fabric, the fabric will keep the tubes together and also act as a hinge that can be flexed with virtually zero friction. This fabric will be also glued to the tubes using PVA glue.

The entire product will be made using MDF which is readily available in the school workshop and also the easiest to work with, specially when a laser cutter is available at hand.

The window for the light tube will be a cut out in the MDF panel which will be replaced by translucent acrylic which is also readily available at the school workshop. The acrylic sheet will be glued using epoxy adhesive, namely 'Araldite' as it is one of the few adhesives that can be used with such different materials.

The storage tube closest to the main hexagonal core will contain the power source (in this case a 5200mAh PNY power bank) and also the lights (in this case, 9 white LEDs connected in parallel with a 100 ohm resistor for each LED). The side of this tube will also have cutouts for the switch to power the LEDs, Female USB a port to connect the soldering iron or charge a device and Female USB b port to charge the power bank itself when needed.

Once finished assembling the product, it will be lightly sanded, then sealed using wood sealer, then painted using poster paint and finally varnished off to finish the product.

Production – Hinges and Joining Methods

Criteria C –
development of a
detailed design

Hinges

Butt Hinge: Comes in a range of sizes from 13mm to 150mm and is normally used for cabinet doors. They are very strong but cannot be adjusted once they are fitted.



Butterfly Hinge: This is often used on light-weight doors and different shapes and patterns are available. They are generally easy to fit.



Flush Hinge: This type of hinge does not require a recess to be cut. They are not as strong as butt hinges but can be used for light-weight doors and small box construction.



Barrel Hinge: This comes in two parts. The threaded part of the hinge is screwed into a pre-drilled hole. They are easy to fit and the hinge can be dismantled.



Concealed Hinge: These normally come in two sizes (25mm and 36mm). The hinge is adjustable once fitted and is designed with chipboard and MDF in mind.



Continuous Hinge: This is a hinge that comes in different lengths and can be bought in brass or steel. It is ideal where a long hinge is required such as a desk top or a cupboard door. Small countersink screws are normally used to fix it in position.



Joining Wood

Screws: Two sizes of hole are needed. The clearance hole must be very slightly bigger than the shank of the screw so that the shank can move freely in the clearance hole. The pilot hole must be smaller than the core of the screw so that the core fits tightly into it.



Nails: Nails are cheaper and easier to use than screws and come in many shapes and sizes. Holes need to be drilled to prevent the wood from splitting, or when using hard woods.



KnockDown Joints (KD): Knock-down (KD) joints are commonly used in flat-pack furniture, which is assembled by the customer at home. Usually KD joints are made from a plastic, such as nylon.



Frame Joints: Strong, permanent and neat-looking joints in wood are achieved using one of the many types of frame joint. Frame joints are right-angled, jointed frames common in furniture, boxes and many other types of assembly.



Mortise and tenon

Joining plastics

Plastic products are often molded so they just snap together. If you have to make a permanent joint, a specialist adhesive is often the best choice.

Plastic adhesives

- **Plastic weld** is a multi-purpose plastic adhesive that joins most types of plastics (do not use it on foamed plastics).
- **Tensol 12** is good for acrylic. It is quick and easy to use. But if spilt it marks the work. It is not very strong.
- **Tensol 70** is much stronger. It is acrylic based. It comes in two parts. It is not easy to use, as it takes 1.5 hours to harden and contracts.

This information has been taken from:

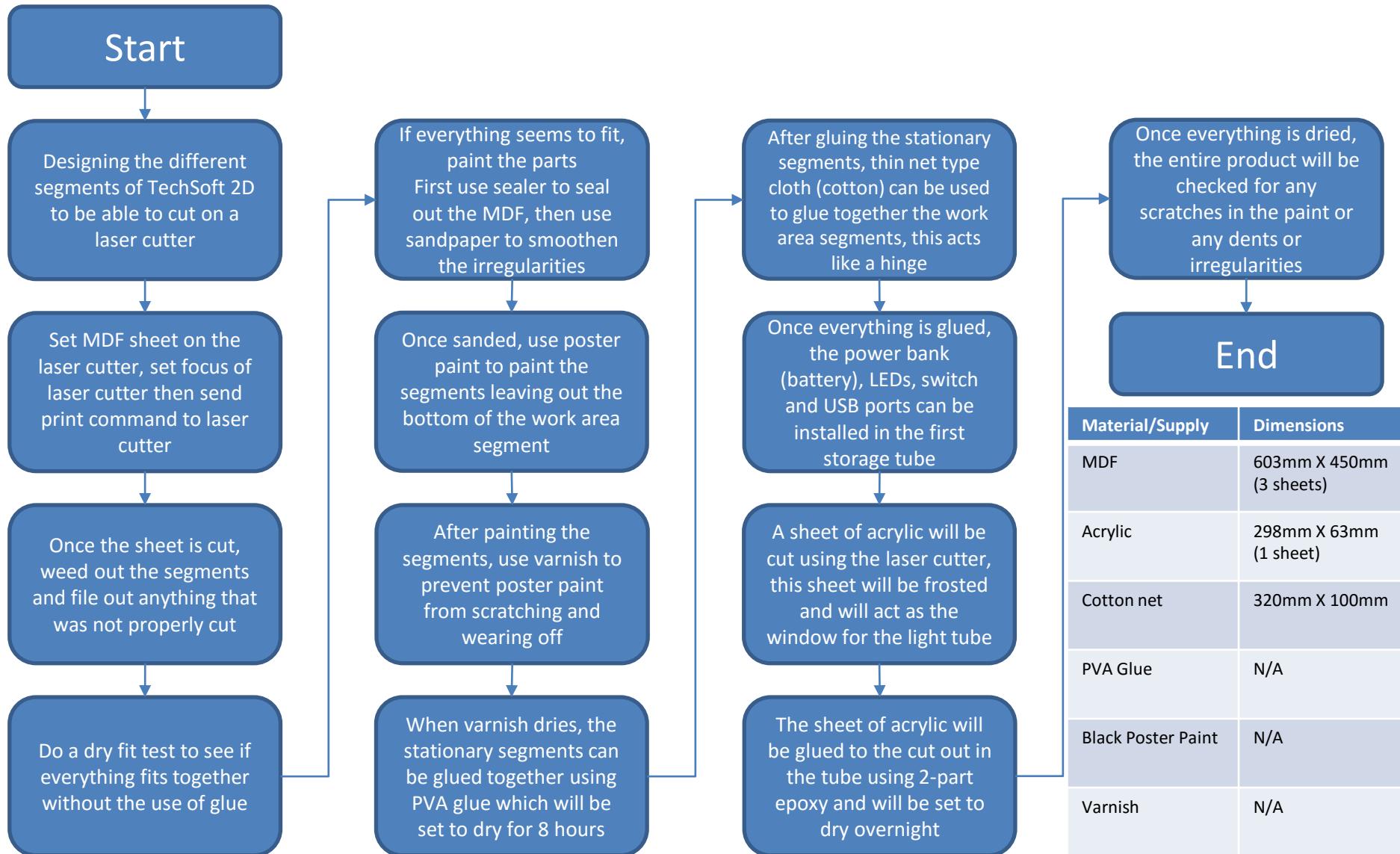
<http://www.technologystudent.com/joints/hinge1.htm>

<http://www.bbc.co.uk/schools/gcsebitesize/design/resistantmaterials/materialcomponentadhesivev3.shtml>

<http://www.bbc.co.uk/schools/gcsebitesize/design/resistantmaterials/jointsrev5.shtml>

Production – Manufacture of Prototype

Criteria C –
development of a
detailed design



Final product – Testing and Evaluation

Criteria D – Testing and evaluation



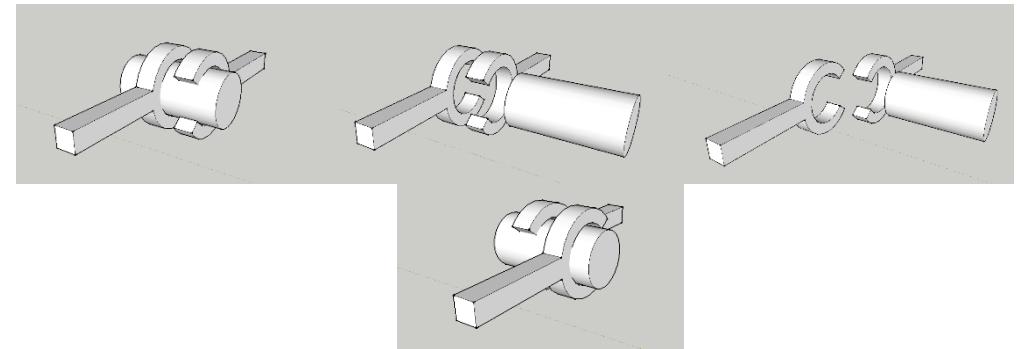
Final product – Testing and Evaluation

Checking against the specifications

Suggested Improvements

Requirement	Specification	
Aesthetic Requirements	Not very important, but should be robust and strong	✓
Cost Constraints	Since it will replace buying a table, tools and storage, consumers should be willing to pay more than a regular storage box	✓
Customer Requirements	should have enough storage and should be able to be used in most places possible	✓
Environmental Requirements	should not harm the environment when being produced, and should be able to filter the solder fumes	✗
Size Constraints	should not be too big as it is supposed to be portable, but should also not be so small that working on it gets difficult	✓
Safety Considerations	Should not have sharp edges and should have safety measures taken into account for tools like the soldering iron that get hot	✗
Performance Requirements & Constraints	should be able to be used easily with minimal construction and should be easy to maintain	✓
Materials Requirements	materials used should be resistant to heat and not deform or break under stress	✓
Manufacturing Requirements	should be easy to manufacture with either additive techniques used or forming techniques used to reduce waste	✗

- The first and obvious improvement is to add a locking mechanism to hold the product together, this will eliminate it from opening when turned over itself and help prevent tools from falling out. It will also keep intruders away from the tools. This could be achieved by using a sash lock or even Velcro to keep the production costs low
- The edges need to be curved as well, as right now they are sharp and might poke or cut the user
- In the existing product, there is no fume extraction unit, which was a specification in the proposed design, this can be added in one of the storage tubes
- A lanyard or a handle should also be added for it to make easier to carry around as it is supposed to be a portable product
- The compartments in the core should also be customizable so that tools of different sizes could be stored
- When mass produced, it should use additive or forming techniques such as injection molding rather than wasting techniques (laser cutting)
- To enable mass customization, the storage tubes can be made in such a way that they can be interchanged; this can be achieved using magnets or even specialized hinges that can be taken apart



Commercial Production

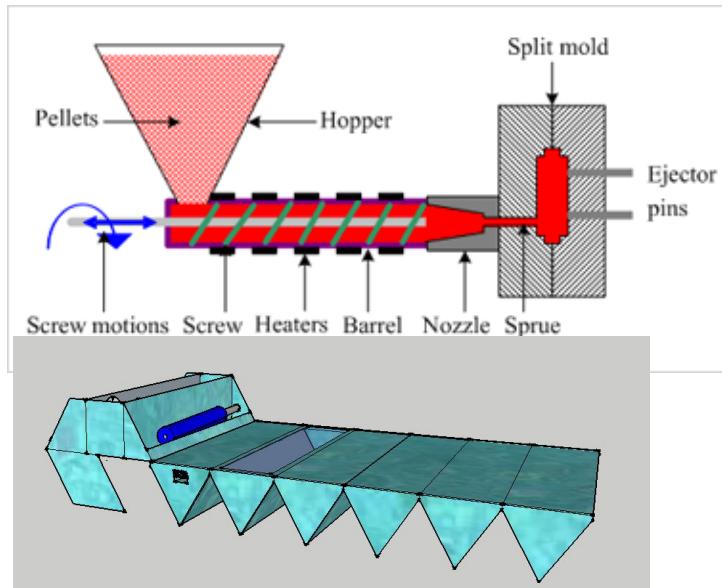
Criteria E –
Commercial
production

In order to commercially produce the product, it should be either mass produced or batch produced.

Mass Production

To mass produce the product, it can be produced using injection molding as it will not waste any materials and is a very quick volume production method since it uses melted plastic which is formed using a mold.

The product can be injection molded where in parts of it would be separately produced and then either assembled by the manufacturer or the user depending on the marketing and pricing strategies used. While being mass produced, the product can also be mass customized by letting consumers design how they want their product to look and function, since components will be separately produced, there is room for users to modify the tools and other accessories such as the power bank. The manufacturer can also offer to engrave the users name on the product itself, as a lot of hobbyists including me like to label there tools with their own name.

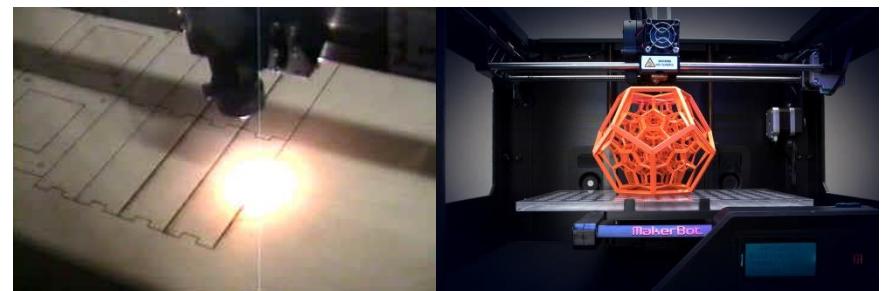


Batch Production

To batch produce the product, it can be produced using 3D printing as it will not waste any materials and laser cutting techniques can also be used as they are very quick but waste a lot of material. These two techniques offer customization to great extents and the designs that are given to the printer or the cutter can be very easily altered according to the designs the customers want on it. The product can be 3D printed or laser cut where in parts of it would be separately produced and then either assembled by the manufacturer or the user depending on the marketing and pricing strategies used.

While being produced, the product can also be mass customized by letting consumers design how they want their product to look and function, since components will be separately produced, there is room for users to modify the tools and other accessories such as the power bank. The manufacturer can also offer to engrave the users name on the product itself, as a lot of hobbyists including me like to label there tools with their own name.

But these two methods would be kept as the last resort as they have a very large lead time and are good for prototyping and not volume production whether it be batch.



Commercial Production – Mass Customization

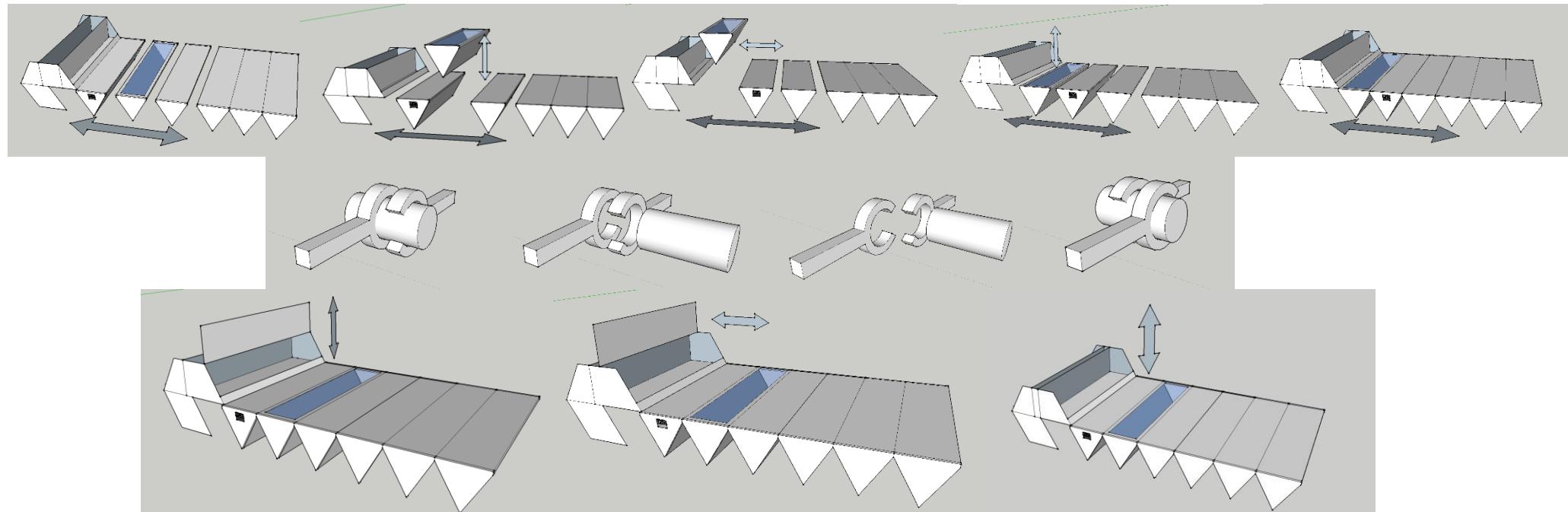
Criteria E –
Commercial
production

Mass customization can be offered by enabling users to interchange parts such as storage tubes and also the core separator. This would allow users to have their product in the most personal way and use it in a manner that suits them the best. This would allow for greater sales as people will not be restricted to one exact product, this freedom should attract many more customers at little to no extra production cost.

These interchangeable tubes can be achieved by using specially designed hinges that allow for the user to take the hinge apart and lock it back together. Using such a hinge will allow for the storage tubes to be interchanged in a way that users can place their required tools in the manner they find the most comfortable.

The core separators can also be exchanged or removed based on the users needs. This can be achieved by making slits in the walls at equally spaced distances, these slits will allow for the separators to be slid into to make different components for different tools.

Another method of customizing the “Solderable” would be to allow users to add different designs to the body of their product, such as different color fills or even different effects such as marble.



Commercial Production – Price Evaluation

The images below show the costs involved in the product of the product. These costs are only rough estimates as actual material cost will depend on the number of units actually produced, which I have estimated to be 100000 units.

The fixed costs are (estimated for 100000 units):

\$60000 (average injection molding machine price)
\$8000 (average mold cost – 3 molds will be made)

\$84000 (total fixed cost)

The variable costs per unit are:

\$13 (average material – ABS)

\$2 (unexpected costs)

\$15 (total variable cost)

These are only rough estimates as costs for labor, land, packaging, shipment and marketing have not been included. If these were to be included, the breakeven point would shift to the right in the graph meaning that more units will have to be sold to breakeven as compared to 1001 units right now.

The total cost of production per unit is:

$$15 + (84000/100000) \\ = \$15.84$$

This is the cost of only producing the product, there will be additional costs per unit as follows:

Soldering Iron : \$8

USB Cable : \$5

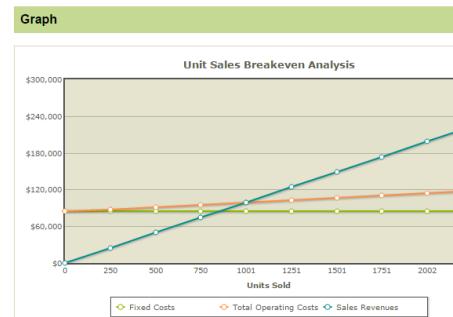
Dremel : \$60

Power Bank : \$15

LED light bank : \$3

Since the base model will be sold with just the power bank, iron and cable along with the product, the price of the base model will be : \$43.84

There will be extra costs for hinging, finishing, marketing, inventory, distribution, packaging and locking mechanism as well. Due to these costs, I have chosen to set the price at \$99.



Detailed Data Table

Units Sold	Sales Revenues	Variable Costs	Fixed Costs	Operating Profit
0	\$0	\$0	\$84,000	-\$84,000
250	24,776	3,776	84,000	-63,000
500	49,553	7,553	84,000	-42,000
750	74,329	11,329	84,000	-21,000
1001	99,105	15,105	84,000	0
1251	123,881	18,881	84,000	21,000
1501	148,658	22,658	84,000	42,000
1751	173,434	26,434	84,000	63,000
2002	198,210	30,210	84,000	84,000
2252	222,986	33,986	84,000	105,000

The pricing strategy used for my product is psychological pricing, which leads the users to believe the product is being sold at \$90 whereas they are closer to paying \$100.

Marketing Techniques – E-Commerce

Criteria F – Marketing strategies

The product will be marketed in various places such as magazines, websites and shops.



The logo shown on the left is one that depicts a product that is related to soldering and also displays the name “Solderable” clearly.

The name “Solderable” has been chosen as it is a mix of the words ‘Portable’ and ‘Solder’, this mix of the two words suggest the act of portable soldering.

Solderable - All-in-One Soldering Solution
\$99.00
BUY NOW **Choose Upgrades**

Contained in a sleek black container, the Solderable is a hobbyists dream come true with ultimate portability for on the go use! Designed by hobbyists themselves, the Solderable will have you fix circuits and modify products that don't even need to be modified or fixed. It's just that intriguing!

The easy to unravel design makes it super simple to use when on the move and catches a lot of attention as well. The unique hexagonal shape doesn't settle for the bare minimum but stands out when compared to other such products.

The tools supplied with the upgraded version are carefully chosen to give you the best experience and no problems whatsoever. And would be the only tools you'd ever need when on the move.

Tools included:

- 5V 8W soldering iron
- 5200 mAh power bank
- Cable compatible with the iron
- Wireless Dremel rotary tool (Upgrade for \$60)
- Light Box addition (Upgrade for \$10)
- Helping Hands addition (Upgrade for \$5)
- Mini Screw driver kit (Upgrade for \$5)
- Metal bodyupgrade (\$50)
- Lanyard (\$2)

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- Speed Controllers (ESC)
- Robotics & DIY
- 3D Printers & Accessories
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Product Finder

FPV MULTISTAR

The two websites shown are snippets of ‘radiochack.com’ (top) and ‘hobbyking.com’ (left). These two websites are online stores that sell tools and hobbyist supplies such as drones and remote control vehicles. The two websites are chosen to advertise and sell “Solderable” because both are very famous for the respective industries and people often look for new and out of the box products. I believe the “Solderable” will be a perfect product to sell on these two stores because both are very closely related to electronics. HobbyKing, which specializes with hobbyists, will be able to offer my product because a lot of hobbyists may want to take a few tools along when they are testing their vehicles outdoors such as airplanes and boats.

Marketing Techniques – Print Media

Criteria F – Marketing strategies



These images show the “Solderable” being advertised in a magazine and also online store called GearBest.

The magazine chosen is ‘Popular Mechanics’ because it is very commonly read amongst hobbyists, electricians and engineers in general.

On the left, the “Solderable” will be advertised in a poster form in the ‘Buyer’s Guide’ section of the magazine ‘Popular Mechanics’ because it can be shown as a recommended product to buy according to the magazine, this would make potential users inquire about it as it is recommended by the magazine itself.

The product can also be shown on the same magazine as a spread which doesn’t only advertise it but also inform potential users about it in a very personal manner – a review by an existing user.

The “Solderable” can also be advertised on ‘GearBest’ which is one of the leading multi-department store that sells everything from electrical appliances to tools and tool-kits. Advertising the price upfront as a low \$99 would attract more people, as the people who buy soldering tools end up sending multiple hundred dollars on a single tool at times.



www.gearbest.com

We celebrate Chinese New Year Festival from Feb 6 to Feb 13. To compensate possible delays we offer even better prices in every category. Local Warehouses content to serve you rapidly.

ENTER CHINESE NEW YEAR CLEARANCE: 12 CATEGORIES, 1 SALE

Shop by DEPARTMENT: Local Warehouses, Mobile Phones, Tablets PC & Accessories, Consumer Electronics, Computer & Networking, Electrical & Tools, Toys & Hobbies, Automobiles & Motorcycle, Home & Garden, Outdoors & Sports, Fashion & Highlights, Mobile Accessories, Watches & Jewelry, Apparel.

Chinese New Year, Gadget, Tool Kits, Projector, Home Gadgets, RC.

GADGET Deals

SOLDERABLE Starting at \$99!

EDUCATIONAL TOYS Bring a smile to their face! \$9.59

LEGO 3D GLASSES II \$89.99

LIDI RC LEP \$149.99

Wii Fit 201 Pro Metrics Boxing R. \$11.50

Ticket XTR Air & Tanker PC \$129.99

Xiaomi Mi Band 2 White LED - 291. \$14.99

Xiaomi Redmi Note 2 32GB 4G Phonet \$159.99

MEN'S HOODIES & SWEATSHIRTS STYLE WRAPPED UP! \$22.99

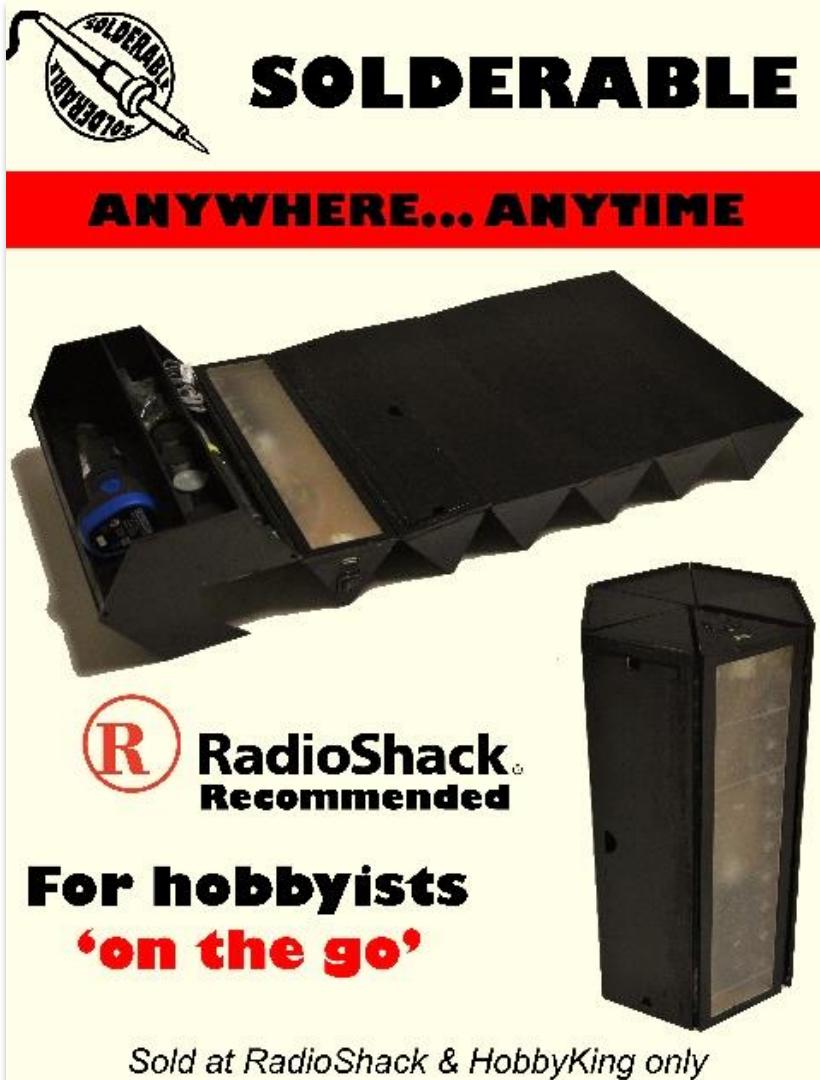
AUDI A261 2K UHD CAR DVR \$211.16 TAKE AWAY

What Other Buyers Are Looking At Right Now:

- Sama XGC New Version XGC - 1 R. \$49.79
- Bentley K2 TV Box 4K H.265 Decoding \$36.78
- DM007 RC Quadcopter 6 Axis Gyro. \$39.34
- Wii Fit 201 Pro Metrics Boxing R. \$11.50
- Ticket XTR Air & Tanker PC \$129.99
- Xiaomi Mi Band 2 White LED - 291. \$14.99
- Xiaomi Redmi Note 2 32GB 4G Phonet \$159.99

Marketing Techniques – Print Media

Criteria F – Marketing strategies



These two images show how the product will be physically advertised outdoors. The image on the left is of a poster that can be put up in physical shops such as RadioShack and HobbyKing. Such adverts will lead users to actually see the product in the store and test it out for themselves to evaluate it.

The poster also says "RadioShack Recommended" which instantly increases the credibility of such a product and pushes people to test it out.

The image below shows the outside of a RadioShack with the posters displayed right at the entrance, such placements capture attention and register information about the product in potential users minds.

These posters will be printed using offset lithography, as it is the most commonly used volume printing method and is also very efficient.



Marketing Techniques - Product

Criteria F – Marketing strategies

The product itself needs to advertise itself as it is one that will be carried around. To allow for the product to market itself, the window on the light tube will be etched in a manner that only the name of the product “Solderable” is not etched. This would be etched using a either laser cutter or sandblasting as they are very effective methods and give a very similar finish to materials like acrylic. Having acrylic etched also prevents any scratched from showing up as acrylic is very prone to scratching.

The side of the “Solderable” will also reserve a place for a logo. This logo will either be stenciled using a restrictive mask and then spray painted or a vinyl decal will be used which will be cut out using a plotter. Using a decal will be a more temporary solution as vinyl can be easily peeled, but it will also offer greater detail and will not need any ‘bridges’ connecting any isolated parts like a stencil would need otherwise.



Marketing Techniques - Packaging

Criteria F – Marketing strategies

Boxes need to be made for the product to be transported and sold in to protect it, advertise it and also inform users of its information. The boxes will be made from corrugated cardboard which is the most ideal and commonly used packaging system as it is quite cheap and also very effective, plus it can be reused and recycled, making it a more eco-friendly choice for packaging. The box will also contain foam peanuts to protect the “Solderable” from any damage when transporting as it is a heavy product, and being heavy means it is also prone to damage if dropped. The box will have printed the product itself and the logo and also information about the product such as what accessories were added to the product and also any customizations that were requested by the user. These boxes will be printed using flexographic printing methods, as they are the most widely used and available method and is also very efficient, where in an inked rubber slab is pushed against the substrate (box) and the ink is then transferred to the box. This method is widely used with volume and also batch production as it is not very expensive to set up and has a very less lead time.

Flexographic Printing: “Often called “flexo” printing, this is the most common method of printing on corrugated and is often executed on the same machine and at the same time “in line” as it converts a corrugated pad into a box. Formerly known as aniline printing, flexography uses flexible rubber or polymer plates to transfer an image onto corrugated much like a mechanized rubber stamp. Fast-drying, water-based inks are generally used, which allow for fast running speeds. The print quality is dependent on many variables, and is influenced by the absorbency of the material being printed. By nature, corrugated material is highly absorbent and thus flexo printing is not recommended for high definition graphics. For straight text or 1-2 color graphical images, this method is ideal. Flexographic printing is very economical and is utilized in large or small production runs.” – Taken from : <http://glbc.com/print-and-graphics/print-types>



Marketing Techniques – Delivering to Customers

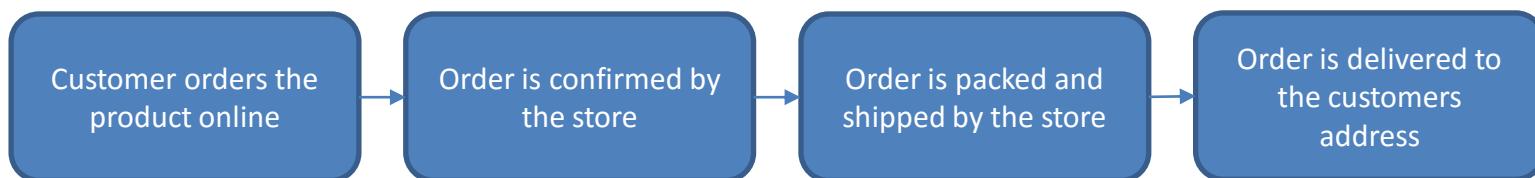
Criteria F – Marketing strategies

The product will be bought online on various stores as mentioned before. These stores will be process, confirm, package, ship and finally deliver the product to the customer.

The estimated shipping cost is:

Priority Mail Express™ Options - Money Back Guarantee	>> Click to View these Mailing Options		
Priority Mail Express™ Hold For Pickup Options - Money Back Guarantee	>> Click to View these Mailing Options		
Priority Mail® Options	Expected Delivery Day	Retail	Click-N-Ship®
<input checked="" type="radio"/> Priority Mail 2-Day™ <small>(?)</small>	Fri, Feb 26	\$13.55	\$13.55
Priority Mail® Hold For Pickup Options	>> Click to View these Mailing Options		
Other Options	>> Click to View these Mailing Options		

The limitation with this cost is that this cost of \$13.55 is only an estimate and is only for domestic postal within the USA.



Order Details

Order ID:	111970698 (1 Item)
Seller:	Solderable Review Seller
Order Date:	25 January, 2016 9:37 PM
Amount Paid:	✓ Rs. 7000 through Credit card

MANAGE ORDER

PRINT ORDER	EMAIL INVOICE	CONTACT US
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PRODUCT DETAILS

	Solderable - All-in-One Soldering Solution Qty: 1 10 Days Replacement	APPROVAL	PROCESSING	SHIPPING	DELIVERY	SUBTOTAL	
		on Sun, 31st Jan by Fri, 5th Feb Standard Delivery					
		Your item has been delivered. Sun, 31st Jan 07:19 pm New Delhi Your item has been delivered View More ▾					
							Rs 7000 [?]
							Send message

[RETURN](#) [REVIEW PRODUCT](#)

