Design & Technology
PORTFOLIO

GCSE PROJECT - SNOWBOARD

POL BERNAT BELENGUER

AQA CONTEXT

The Context

My family and I go skiing every year. I started skiing when I was 5 years old and went on until I was around 12, when I changed to snowboarding. I did this mainly because my sister had changed too and seemed to have a great time always when we went skiing. I've now been snowboarding for 3 years and I have come up with a problem: there's no snowboard which fits the style I like and enjoy when I go skiing. All snowboards are especially designed for a specific type of style: to jump in the snow park, to go off-piste or simply a purely aerodynamic snowboard for speed on the slopes, and this is what I feel should be changed. Me and my sister personally prefer to be able to go down the slope with speed but always like to make some jumps or go off-piste for a bit, sort of like a hybrid snowboard; and I am aware of many people who also don't enjoy snowboarding when they have to do it with a style inconvenient to them. Moreover, I have never seen a snowboard which has been designed with an aesthetic point of view, does the job I personally want it to do properly and is substantially cheap.

What I aim to do in this project is to enable the individual to express his own style and likes or dislikes of a normal snowboard so I can put it all together and design to produce a new and revolutionary type of hybrid snowboard specifically for his or her style. There is also a need for this snowboard to be very resistant and robust as it has to be able to be durable for many years without breaking after its monthly/yearly use without it snapping in half which is one of the main dangers in snow boarding.

Recently I talked to one of my friends who had broken one of his leg bones skiing and this was simply because he was using a snowboard which didn't match his style. Because snowboards haven't evolved much at all from when they were originally invented I think there is the user's need of a new product which will make snowboarding much easier and more comfortable for every individual.

Target User Group

The target market should be as broad as possible. However the potential aim of this product is to a teenage – adult girl/boy aged around 12 – 24. The client will mostly be of a middle class because it is made for someone who is able to go skiing every year, however as an assumption of the target client he or she won't have much money to spend as he/she will be in the process of becoming independent and therefore won't be able to spend huge amounts on a good snowboard.

Preliminary Criteria

It is essential that the snowboard is:

- Very robust so that it can withstand big impacts when jumping and snowboarding down the slopes.
- Stable.
- Water proof.
- It has to have very flat and soft edges with a bottom surface which can glide through snow easily.
- It must fit the snowboarder's personality so that the weight and the snowboard is balanced out properly.

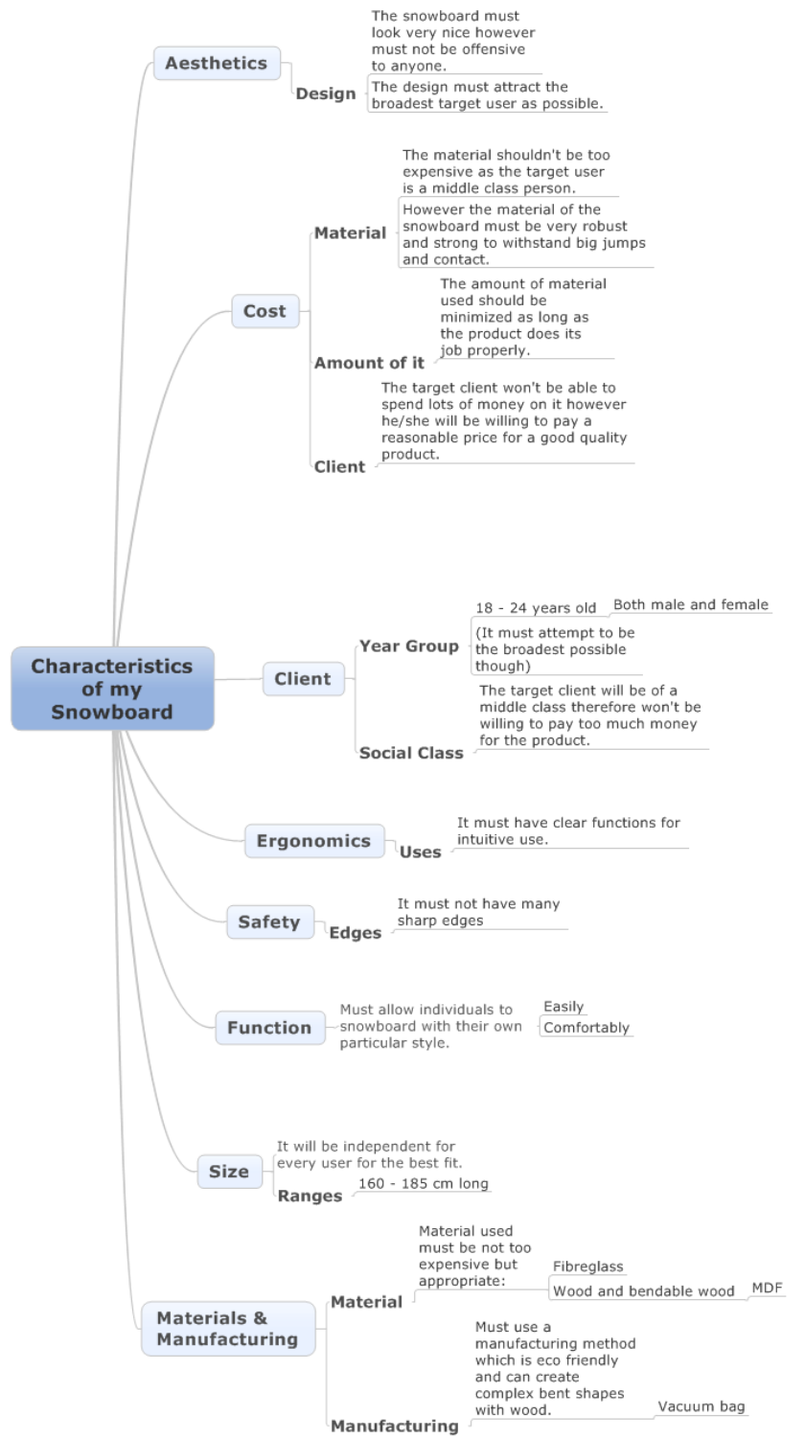
Investigation Plan

I will:

- Research various materials, such as fibreglass and types of wood, for my product.
- Find out different structures that existing products have and analyse them.
- Research how snowboards' style and shapes have evolved over the last decades.
- Produce a questionnaire which will be answered by my goal market.
- Research on how the aesthetics of the product can vary the target market.
- Ensure the product causes no offence.
- Research the correct anthropometrics.

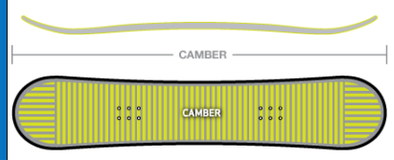
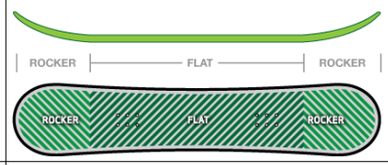
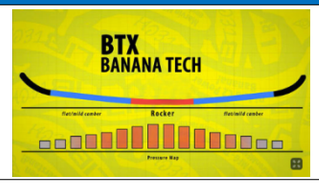
Context Analysed

I used the context of my project to make a starting analysis to summarise the specifications I came up with on the page:



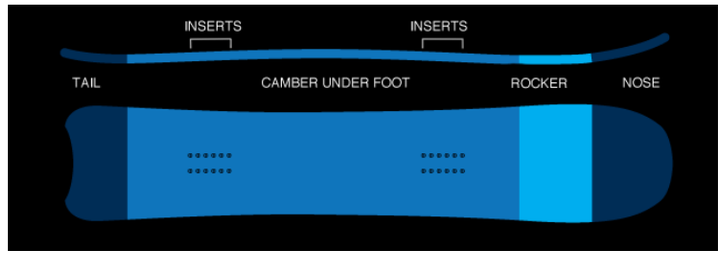
I will now use these specifications to analyse market products against it and compare it to a design era.

Existing Product Criteria

Criteria	Product 1	Product 2	Product3
Photos of the Products >>			
Source	http://www.boardworld.com.au/snowboarding/guides/snowboard-characteristics/	http://www.evo.com/rocker-guide-what-is-rocker-and-why-does-it-matter.aspx	http://www.lib-tech.com/snowboarding/technology/
Function	This kind of snowboard is known as camber and it's mainly used for normal riding and its shape gives it a very alert responsive feel to any bumps or irregularities on the snow.	This kind of snowboard is known as rocker and it's mainly used as a free style and off-piste snowboard as its "U" shape offers it a superior float on soft snow.	This snowboard is a specific brand which fuses all the good things from the camber and the rocker boards and puts it all together into a single board with a Lib tech.
Style	This was the original shape and curve snowboards were made from. It's mainly used for a sort of basic board as a starter for someone who hasn't really defined his/her style of riding yet so they are all-mountain free ride boards.	This style of snowboard was one of the firstly made ones and it is very particular and specialized for deep and soft snow and for an ease to jump and pop/Ollie. It has an increased ease of turn initiation so you don't generally "catch" the edge.	This is snowboard has a very characteristic shape and bend in it and this is what it makes it a very advanced board which actually has a more volatile purpose and can be used in many different situations (ie. soft snow, carving etc.).
Materials	N/a (As most boards made out of different materials, however generally I found out that boards are made out of UHMWPE (Ultra-High-Molecular-Wight Polythene, This material is usually used as it has a very low coefficient of friction and is highly resistant to abrasion).	N/a (As most boards made out of different materials, however generally I found out that boards are made out of UHMWPE (Ultra-High-Molecular-Wight Polythene, This material is usually used as it has a very low coefficient of friction and is highly resistant to abrasion).	The material that this lib tech. uses for their snowboards is very resistant and with the same properties as a usual snowboard would have (low coefficient of friction and resistant to abrasion).
Cost (due to materials/manufacture)	Generally UHMWPE tends to be quite expensive by its own as a raw material and the further manufacturing techniques are so too therefore maybe an alternative should be found so that it becomes affordable for the target market.	This shape becomes much easier to manufacture compared to the camber shape as it only consists of one bend, which is in a "U" shape, and this decreases the overall cost and it becomes more affordable to the target market.	Due to its special technology and complex bend of the board it is a very expensive board with a very expensive method of manufacture which all rises the price making it difficult for the target market to be able to buy the product.
Structural aspects	The sizes of the board vary for every individual however the structure of the camber board makes it very volatile and easy to use for anyone, this is mainly because the weight is balanced out on the to points of contact the board has with the snow. It follows the Bauhaus style as it becomes an object for an everyday person which uses new materials and manufacturing processes.	As it consists of a simple shape it becomes a more easily manoeuvrable board which makes it more comfortable for a certain group of individuals. It can also refer to the design period of Bauhaus as a very simple shape is used which fits and performs its job.	Due to its edges and shape the board gives all the good things about the camber board and the rocker board and it puts it all into one. This brand has so far been the most revolutionary brand on snowboards by creating their own shape and characteristics to their snowboard, however this also became really expensive (around 400-500£ for a board).
Sustainability	It uses a very strong material which is highly resistant to abrasion. The amount of material used is convenient for the contact and pressure it is taking in.	It uses a very strong material which is highly resistant to abrasion. The amount of material used however must be more as it has a less resistant shape and design more easily broken.	It uses a very strong material which is highly resistant to abrasion. The amount of material used however is more which makes it a harder and more resistant design.
Analysis of each Product	It is an overall good product which covers the basics of snowboarding however the whole aim of my product is that it develops into a more innovative and developed era of snowboards and this is the original and "boring" one I have to overtake to satisfy the individual fully.	This type of snowboard summarizes and refers to my final product more easily and solidly however as it also performs a very specific job and it wouldn't be good enough to speed down a slope with a considerable speed as it is too specific for deep snow and jumping.	The Lib Technology was very revolutionary in 2007 by mixing the two existing types of snowboard to get the best from each. This is the idea I'll try to re-do but by improving it as a more revolutionary idea.

Design Themes of the Last 100 years

BAUHAUS (1919 – 1933):



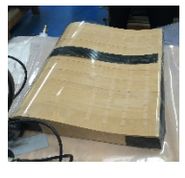
- FORM FOLLOWS FUNCTION – design a product to work efficiently first, then see how it looks.
- EVERYDAY OBJECTS FOR EVERYDAY PEOPLE
- PRODUCTS FOR THE MACHINE AGE – products should be designed to be made using new materials and manufacturing processes.
- SIMPLE GEOMETRIC FORMS – designs should use clean lines.
- Bauhaus designs are: Geometric, functional and modern, and use asymmetry, rectangular grid structure, circles, squares, rectangles, triangles, bars etc.

I will attempt to incorporate the criteria of form following function in my design so that it becomes more functional than aesthetic therefore a more useful design, and maybe use simple geometric forms to the design of my snowboard. For example the snowboards shown doesn't attempt to be aesthetic but is really purely functional to undertake a specific objective.

Project Specific Research

I decided to try laminating with some plywood in a vacuum bag, as it is a possible manufacturing method for my snowboard. When laminating:

1. You firstly cut the plywood into the desired shape and size (around 5 layers of thin plywood are used, however my snowboard will most possibly be made out of GRP).
2. The Former is then made. This is the template with the curve so when put in the vacuum bag it takes that shape.
3. The plywood is then stuck together by coating the spaces between layers with a PVA thermosetting cross linking plastic glue.
4. The Vacuum bag (made out of PVC plastic, so the glue doesn't stick to it) is then set up with the vacuum machine, which will suck the air up in the bag to create a vacuum.
5. The plywood sheets with the former are then put in the vacuum bag which is sealed on both sides.
6. If the bend is too steep the wood might need to be hydrated so it can bend further.
7. The ply is then left in the bag for 24 hours until it sets into shape and fixes.

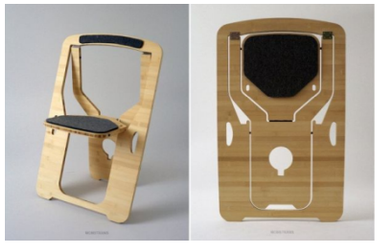




STYLE INDEX

This wall mounted staircase is exclusively made out of planks of wood which are attached to the wall horizontally in order to serve as steps to. It is a very minimalist design which I really like as it is useful and stylish, however it doesn't necessarily seem the safest staircase as there is no support to go up the staircase (if you loose balance you might have a 3 metre fall) and the planks of wood don't seem to have any metallic support under them which means that in case of bringing a heavy load upstairs it could break. Moreover there are many dangerous sharp edges at crucial heights.

This foldaway chair is a very exclusive design as it becomes a really flat piece of wood which takes up very little space and can easily be stored away, however it produces a very straight position which doesn't seem very comfortable. The designer has had to sacrifice the element of comfort in order that the chair is able to fold away.



A very exclusive design combining two different styles of dirt biking. This is a similar idea to mine which might combine various types of snowboarding styles whilst becoming an affordable conveyance sport.

This is Stark's lemon squeezer. It has a very simple design, probably being inspired in a spaceship, which insect-like legs, which gives it a very futuristic look. As well as looking aesthetically very good it is also a very useful piece of apparatus in a kitchen. However the factor of beauty and aesthetics has had to sacrifice the efficiency therefore not following the Bauhaus style.

A leaf, which can seem very simple and straight-forward from the outside becomes a very complex structure, as you look at it closely, to execute perfectly its purpose. Where the aesthetics follow function, but it is still aesthetically pleasant.

This is the Magista football boot. It is a complex design combining a sock with a football boot, which makes it much more intuitive to play football. It is a very intelligent design and is combining the elements of comfort, effectiveness and is also aesthetically attractive.

SOCIAL & MORAL ISSUES

Although the snowboard product I'm designing is exclusive, targeting only for a user group aged between 18 – 24 years old, I will attempt to design my product respecting what an inclusive user group would be tolerant to but still designing for my target market in concrete. The graphic designs I will produce for my snowboard mustn't be offensive towards anyone respecting different cultural beliefs however must be fashionable and trendy always so that my target user group will still be attracted by the design of it. I will research the possible aspects of my design and ensure that they are not offensive towards anyone (IE. Revealing designs or offensive in disgust).

The design should be morally correct so that the graphics and design do not offend anyone in any way. It mustn't have a bad influence on anyone to make them become angry or anxious about anything stated or acknowledged from my product.

The manufacturing methods should not have negative effects onto the environment and the materials used should be re-usable in order not to produce pollution which would then be fed into the sea, becoming morally and environmentally bad for the Earth coexisting in a harmonious way. For example, considering using a type of plastic, a thermosetting plastic wouldn't be morally correct as once it is no usable anymore it is dumped causing pollution, however a thermoplastic type of plastic would be able to be melted down again and remoulded for a new use if broken. Although a machine processed product would be more efficient and less expensive for production it wouldn't be morally correct as lots of jobs could be created, if I was to mass produce my product, and the workers should also be treated in a fair way, not such in sweatshops where some workers or even children are sometimes exploited. The factory would also be created in a wealthy local area to be socially and morally accepted by the society. Once it is produced and manufactured it mustn't have any negative effects on the environment and or a negative influence on anyone.

1. For example the design of the snowboard shown might be found offensive due to the highly revealing pictures of the female anatomy to younger people or the blood and disturbing pictures of fingers being chopped off wouldn't be socially inclusive therefore the user might see the product as an offense to their culture or thoughts.

ENVIRONMENTAL ISSUES & SUSTAINABILITY

In order to make my product sustainable I will always ensure the materials I'm using are sustainable to use. For example, Bamboo is a really good choice of wood because it has the properties needed in a snowboard (very strong, shock absorbent, robust) and grows very quickly, as Bamboo is a grass, and as such, grows much the same way your lawn grasses grow, just on a much larger scale.

The environmental issues affecting my product are the way it is manufactured and the effects this has on the environment. As I am only producing one I it wouldn't be a problem, however if I was going to mass produce this board I would have to come up with a plan to produce it efficiently whilst being environmentally friendly and sustainable. The materials being used should also be re-usable in case of the board braking or snapping in two, therefore the materials would become more sustainable as they could be recycled into something else. I will also try to ensure that no harmful, toxic or pollutant substances are given off during the manufacturing process as they will cause harm to people as well as the environment.

TARGET MARKET QUESTIONNAIRE

CONSUMER PROFILE

My project is aimed for young adults aged 12 – 24, who are from a middle class, therefore able to go snowboarding every year, however not really wealthy in the sense they won't be able to spend huge amounts of money on a snowboard. I will therefore give out my questionnaire around schools and universities where students range that age and bars near skiing resorts, where I will surevy find people who are interested in my product.

QUESTIONNAIRE

1. What is your age: ……..

This is a crucial question because it will allow me to know whether it is part of my consumer profile or not, as I'm going to design my product appealing to my consumer profile.

2. What amounts of money would you be aiming to spend for a good quality snowboard? (NOTE: Most on the market range from 300 – 700)

- ❑ - 200 £
- ❑ 200 – 300 £
- ❑ 300 – 400 £
- ❑ 400 – 500 £
- ❑ + 500 £

I will now have a clearer idea of what materials and processes to use to create my product and this question will help me have a rough idea what my consumer profile wants. Moreover I will be able to see what social class they're in, in order to become more specific when I'm designing my product.

3. What is your favourite ride (2 ticks maximum)?

- ❑ Tricks
- ❑ Boxes
- ❑ Powder
- ❑ Speed

This specification will help me understand what style my target market enjoy when snowboarding, therefore it will help me in my designing of the shape of the snowboard as the shape will depend on the function it is designed for.

4. Which would you rather: Expensive & Good Quality, or Cheap & Average?

- ❑ Expensive & Good Quality
- ❑ Cheap & Average

This, together with the amount of money aiming to be spent by the consumer will help me get an idea of how to manufacture the snowboard and with what materials.

5. How often would you go snowboarding?

- ❑ Every weekend
- ❑ Once a month
- ❑ Twice a year
- ❑ Once a year
- ❑ Never

This question is will be used to see how seriously they take the sport, therefore how seriously I should take their answers into account compared to other people who maybe don't practice it that often.

6. What snowboard shape would you rather:

- ❑ Rocker
- ❑ Camber
- ❑ Banana Tech
- ❑ A different but original shape

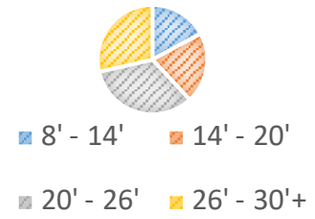
I will use this question to check what preferences my target market have for the shape of the board, which will affect the style.

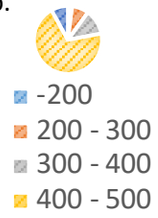
This is simply an aesthetic question to understand the taste of the market.

7. What colour would you like to be predominant on a snowboard: ……..

QUESTIONNAIRE ANALYSIS

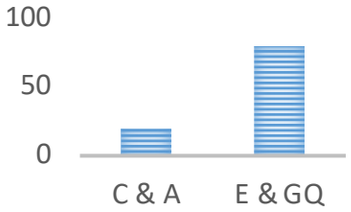
1. Of all the people I asked, 18% were people aged 8–14, 22% were 14– 0, the vast majority 35% were my target group, from 20-26 years old, and 25% of those people were aged 26-30+. Although it wasn't only my target market answering the questionnaire I will take into account those that were not too.





2. The most voted amount of money which is aiming to be spent was 400 – 500 £. 70% of the people chose this option because it is not the most expensive snowboard however it is good quality, therefore that is a good amount of money to be spent.

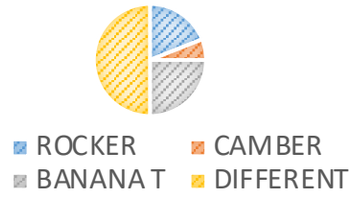
3. The 2 favourite styles chosen were to be able to trick and go on powder, which together held 72% of the votes, however speed was also widely chosen, taking 25% of the votes, therefore I will attempt to make a snowboard not only suiting tricks and powder, but will add some detail so it's also suitable to grab some speed so that my market broadens.

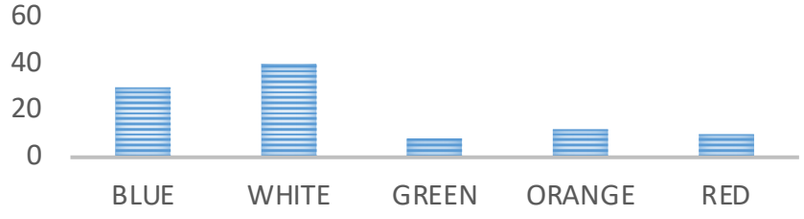


4. 80% of the interviewed chose the idea of having a good quality and expensive snowboard rather than an average and cheap snowboard. This was discovered by question 2 also. This is the answer I expected.

5. The answer was really varied however most people in my target market will go snowboarding once a month generally.

6. 50% of the people chose to get a different but original shape which would apply for the styles the board is going to be specific for. Although ¼ of the people chose to have a banana tech shape I will try to apply that shape to my original shape.





7. The most chosen colours were white and blue. Around 30% of the votes, however, were other colours, which means that I won't discard them, allowing the possibility for me to chose between all of them.

USER PROFILE

This is the target market I am aiming at. A group of middle class teenagers which can afford to go snowboarding on a regular basis and aiming to spend £400 – 500 on a good quality snowboard.

POL BERNAT BELENGUER

DESIGN CRITERIA

CRITERION TYPE	DETAILED CRITERION DESCRIPTION	IMPORTANCE OF CRITERION	RESEARCH LINKS
Function	The snowboard must be able to be ridden to fit the multiple styles that the target user has decided in my questionnaire.	So that this product is worth buying, it has to be able to fulfil its functioning purposes.	Pg. 1 + 4 – Context + Questionnaire
Style (Anthropometrics)	The board must not be longer than 1'80 metres or wider than 1 metre. The separation between each foot must not increase 1'30 metres. It must be designed for a 50th percentile.	This is important as we are building a snowboard to fit the human shape so it is comfortable when in use.	
Ease of Use (Ergonomics)	The board is aimed at a more advanced group of snowboarders rather than beginners, however the board must optimize riding in the chosen styles.	So it is easy and comfortable to use the snowboard, the product has to be able to fulfil this.	Pg. 1+4 – Context + Questionnaire
Safety	The board must not have any unnecessary sharp edges which can cause damage or be able to hurt the user or someone in the environment when the board is being used.	If this weren't the case, and the board wasn't safe, the client could even sue us, and due to the danger in the sport it could have serious consequences.	Pg. 3 – Social and Moral Issues
Market	My target market is aged 18 – 24. The client will usually be from a middle classed family as the product will be manufactured with expensive materials.	This is important because the product must be able to appeal to my target group as it will have to be bought by them. Without a market there's no company.`	Pg. 1 – Target User Group
Material Characteristics:	The board will be laminated and constructed with various materials including wood and fiberglass, which a metal edge.	I must decide the materials which will be used, otherwise I won't be able to order them and use them on time.	Pg. 2-4 – Project Specific Research + Sustainability + Questionnaire
Structural Factors: ▪ Size	The board must not be longer than 1'80 metres, or wide that 1 metre or with fixations separated by more than 1'30 metres.	It is vital as it has to have a size matching with a broad amount of people form my target market.	
▪ Weight	It will have to have weight, but not too much so that it affects snowboarding.	This will be very important as it has to weight something due to the material being used, however this weight will be minimized.	
▪ Stability	The shape must be stable, and although it will be an original shape, it slide with ease on the snow.	It is very important that the board becomes stable because it will define whether it can be used and complete its function or not.	Pg. 1 – Context
▪ Durability	The board will most likely be made out of durable materials, such as fiberglass and bamboo, as a snowboard is a speciality good and must withstand many bumps and shocks.	This is very important because if it doesn't live a long life it won't be worth the money it was bought for.	Pg. 1 – Context
Costing (Economic)	I will use a manufactured wood so it's less expensive, and I will use efficiently the material so there's less waste.	It is vital I do this as, due to the Questionnaire, I've got an expected price I can't overpass.	Pg. 3+4 – Sustainability+Questionnaire
Social issues	The board must not bring offence to any type of group whether they be ethnic, religious or with different beliefs.	This is very important because if it is offensive to a social group they won't buy the product and might even use us.	Pg. 3 – Social Issues
Moral issues	The materials must be bought from a source where no one is exploited to make the products (ie. Sweatshops).	This is vital because it can put off consumers and it is against the ethic of life.	Pg. 3 – Moral Issues
Ecological issues	The product must be manufactured without producing any waste materials harmful or toxic to the environment.	If the manufacturing process is harmful to the environment it will put off buyers. Those toxics will also have bad consequences.	Pg. 3 – Environmental Issues
Sustainability	I will ensure the products being used aren't endangered, therefore won't affect the environment they are taken from.	This is important because if the materials aren't sustainable they'll be expensive and will put off buyers.	Pg. 3 – Sustainability

DESIGN STRATEGY

IDEAS SECTION

Ideas 1

- Arrangement of basic components
- Inspiration from Style Index
- Inspiration from Scruffiti

Ideas 2

- Impact of Interfaces on the design
- Inspiration from a Famous Designer, past or present
- Impact of Local Conditions in which design will be used.

Ideas 3

- User opinion and it's impact on the design
- Impact of moral, social, environmental and sustainability from criteria

EVALUATION SECTION

- Evaluation of ideas and selection of the top 3

DEVELOPMENT SECTION

Development 1

- Effect of Materials Testing on the Design

Development 2

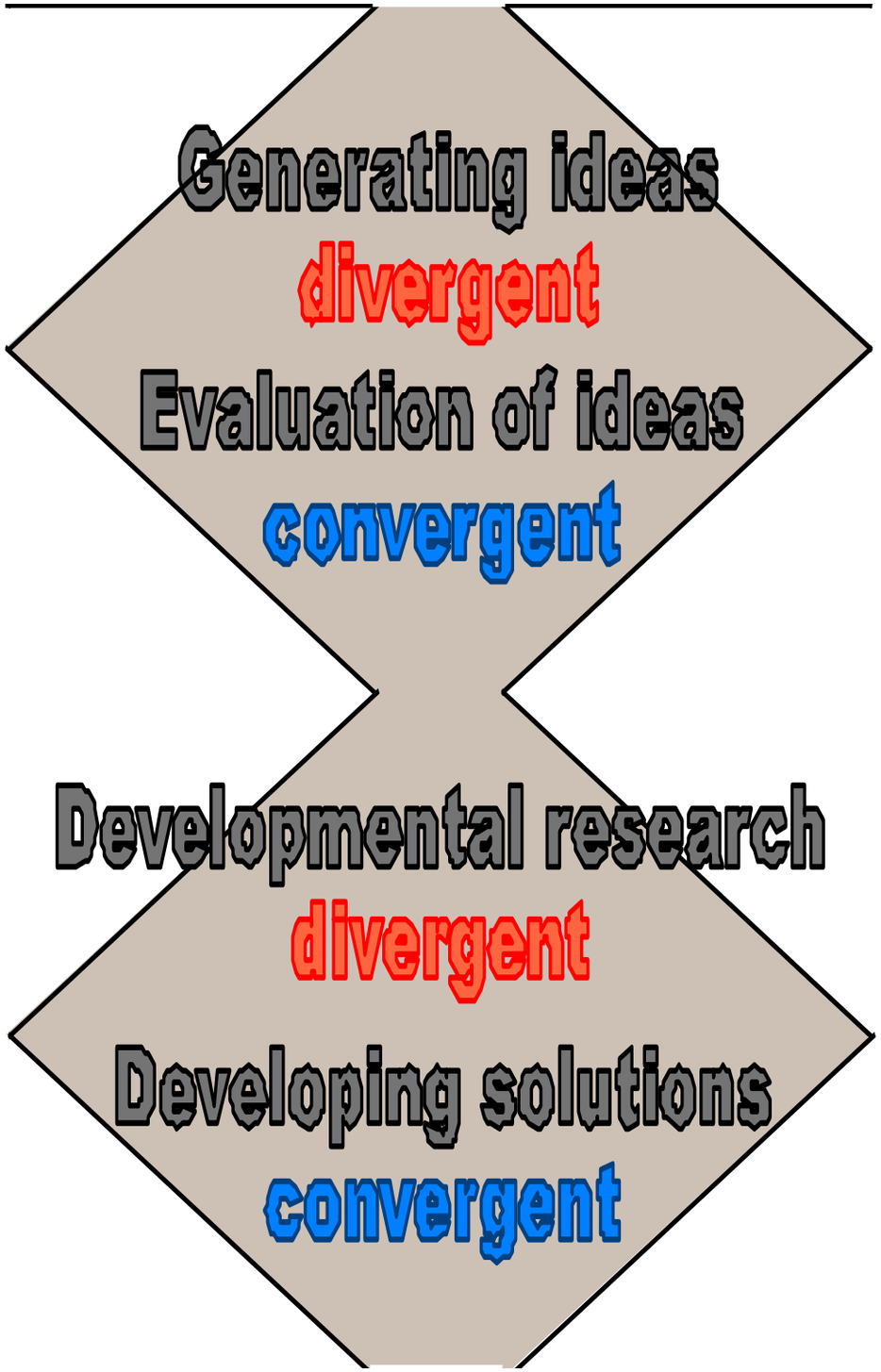
- Effect of trialling Manufacturing Techniques

Development 3

- Impact of selected Bought Components
- Impact of Anthropometric Data
- Impact of Ergonomic Considerations

FINAL DESIGN

- Exploded View of Final Design
- Rendered view of Final Design
- Orthographic Scale Drawings
- CAM setup (if required)



DEVELOPMENT PAGE

Evaluation Criteria	
Function	
Aesthetics	
Physical Properties	
Market issues	
Material qualities	
Cost issues	
Social issues	
Moral issues	
Environmental issues	
Sustainability	

STYLE INDEX

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I’m working on scanning and adding them!
Please bear with me meanwhile

SCRUFFITI

DEVELOPMENT PAGE

Evaluation Criteria	
Function	
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Sustainability	

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SPECIFIC DESIGNER STYLE

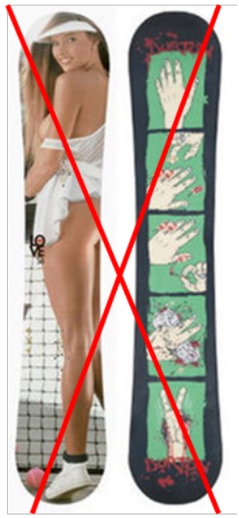
MARCEL BREUER
1902 - 1981

POL BERNAT BELENGUER

DEVELOPMENT PAGE

Evaluation Criteria	
Social issues	
Moral issues	
Environmental issues	
Sustainability	

SOCIAL ISSUES & SUSTAINABILITY



MORAL & ENVIRONMENTAL ISSUES

POL BERNAT BELENGUER

User Comment

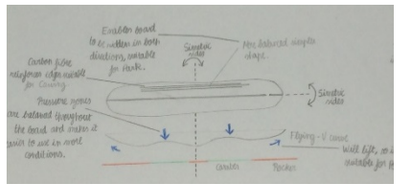
I showed my designs to a third party (two fifth form boys from my school) and asked for his opinions. They told me they disliked the idea of having shapes which are too different, which means it might affect the style of snowboarding. However, they also told me that they were looking for a curve and shape on a snowboard in order to be able to ride the board all-round for various purposes, therefore it had to be different and original in that aspect. This will help me develop further my ideas to fit the target market.

They also rated my ideas on the right and told me which ones they would like to see developed with their criteria. The picture above shows myself presenting my designs to a third party.

Comment Applied…

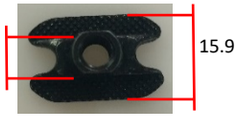
Using the comments and thoughts given by the third party I developed some ideas.

On the right, I used my third design on the table to the right and using the user comment developed it so it had an original curve in order to be used all-round, I also edited the shape so you are able to ride it in both directions (all designs on next page).



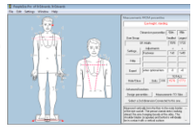
Interfaces

The main interfaces I will be dealing with when making my snowboard are the bindings and all the pieces for the 'Channel System', therefore I bought those parts and measured them so I can have an understanding of what quantities of materials and sizes I should use to create my product. I will investigate them further by modelling around them.



Anthropometric Data

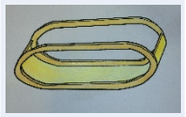
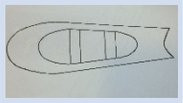
I used a software called 'Peoplesize' and took the average man in the UK sizes in order to understand what measurements my board should be like.



Local Conditions

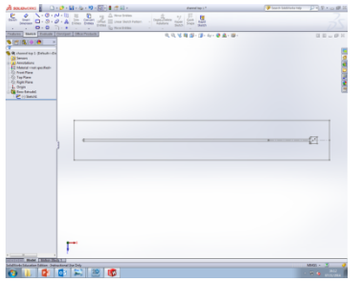
My design is to be used on the mountain down a slope of snow, therefore it must be impermeable and there must be no cracks or faults in it as it would break with water in it. It must also be resistant to hard impacts and must be able to bend if doing tricks in the snow park.

Evaluation of Ideas

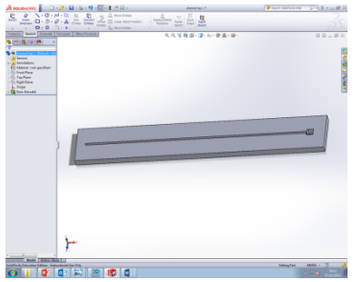
IDEA	FUNCTION	STYLE	ERGONOMICS	SAFETY	MARKET	SIZE	WEIGHT	STABILITY	DURABILITY	COSTING	MORAL	SOCIAL	ENVIRONMENTAL	SUSTANABILITY	<< TOTAL	ANALYSIS	TOP 3
	✓ 7	✓ 9	✓ 6	✗ 3	✓ 8	✓ 10	✓ 9	✗ 2	✓ 7	✗ 4	✗ 5	✓ 7	✓ 9	✓ 8	94	This board is too radical, so it affects the stability and safety, however it is a nice design I won't discard.	
	✗ 3	✗ 4	✗ 2	✗ 4	✗ 2	✓ 8	✓ 7	✗ 4	✓ 7	✗ 3	✓ 6	✓ 7	✓ 7	✓ 8	72	This design doesn't work properly due to the double concave curve in it therefore I will discard it due to the poor ergonomics and safety regulations.	
	✓ 8	✓ 9	✓ 10	✓ 9	✓ 10	✗ 6	✓ 8	✓ 10	✓ 9	✓ 9	✓ 10	✓ 8	✓ 10	✓ 9	125	This design came out on top, it follows all the criteria and it is also aesthetically pleasing.	
	✓ 7	✓ 8	✗ 5	✗ 4	✓ 7	✓ 7	✓ 6	✗ 5	✓ 8	✗ 4	✗ 5	✗ 3	✓ 6	✓ 6	81	It is a very original snowboard, which my target market like, however it is not safe as you could break a leg easily with the shapes extruding all the way around the board.	
	✗ 4	✓ 7	✓ 6	✓ 6	✓ 8	✗ 5	✓ 7	✗ 4	✗ 3	✓ 6	✓ 7	✓ 8	✓ 7	✓ 7	85	The fact there is a hole through the board means the snow will clog up in front of the bindings, moreover, these stripes going through will be easily broken as it is where the most pressure will be applied and where the board has the least support.	
	✓ 6	✗ 4	✓ 8	✓ 7	✓ 7	✗ 4	✓ 7	✓ 8	✓ 7	✓ 7	✓ 8	✗ 3	✓ 8	✗ 4	85	It is a very simple design, which my target market don't like, and although it works properly in order to make the exaggerated shape on the back will mean lots of testing which will have a sustainable issue as lots of wood will be wasted in the process.	
	✓ 8	✓ 9	✓ 6	✗ 4	✓ 6	✗ 4	✓ 6	✗ 4	✓ 7	✓ 8	✗ 3	✗ 2	✓ 7	✓ 6	80	I don't like this design because it is trying to fuse skiing with snowboarding in a way it makes riding difficult and too focused on one characteristic, speed.	
	✓ 7	✓ 8	✓ 9	✗ 5	✓ 8	✓ 7	✗ 5	✓ 8	✓ 9	✗ 5	✓ 7	✓ 8	✓ 7	✓ 9	102	This design is both a set of skis and a board, my target market really likes it however it will be very complicated to make.	

Model Making

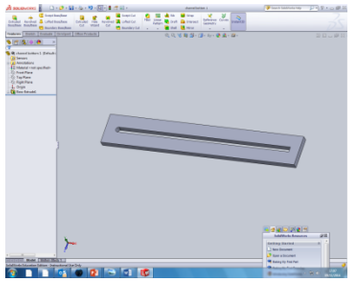
The “Channel” Technology



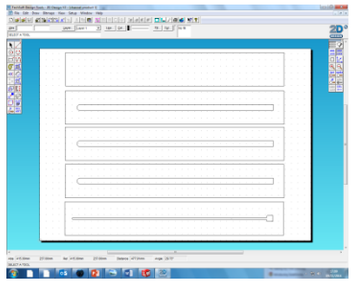
I decided to make a layered model of the channel binding technology designing around the interfaces, I firstly drew my design with measurements in Solid Works.



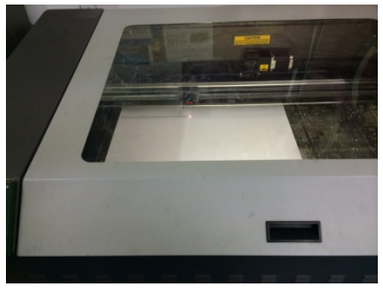
I then Extruded my design on Solid Works so it became a solid, and I could extrude my design to the 2D Design software which the Laser Cutter will then cut out.



I repeated this method with the next layer I needed and finally had all the layers saved.

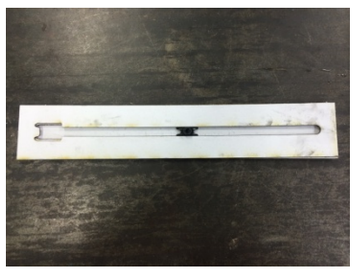


I then saved the top views of each layer as a “.dxf” file so that it was compatible with 2D Design, and I placed the pieces on what will be the piece of card minimizing the waste by nesting it.

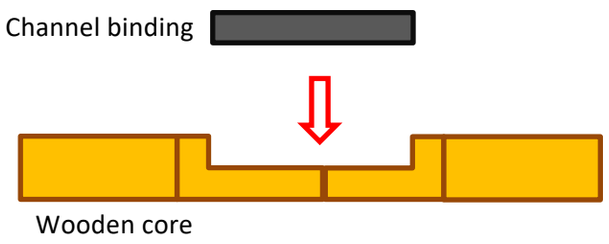


I then set up the laser cutter by placing the cardboard in it and setting up the thickness of the card (0.8mm).

Once I had the separate pieces which I had to go over with a scalpel, I stuck the layers together using a hot glue gun, and tried if it worked with the interface, and it did.



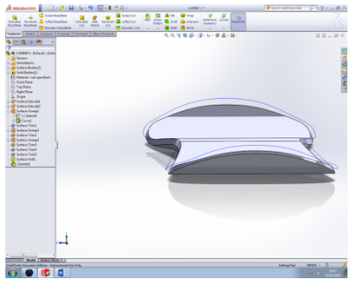
For my board I will have to do the same thing but with metal plates instead, therefore using the plasma cutter instead of the laser cutter.



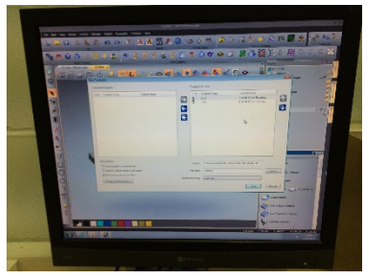
When placing the channel binding on the board, as it will have a thickness, I will have to integrate it on the board, therefore cutting out the area of the binding on the board so it is integrated and doesn’t stick out.

Manufacturing Techniques Explored

Using the AXYZ CNC Router introduction

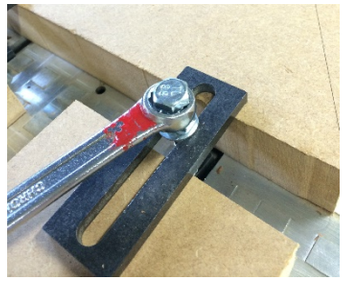


As this is the machine I am going to make the core of my board out of, I had to make sure I knew how to use it. I firstly designed a simple board in 3D on SolidWorks.

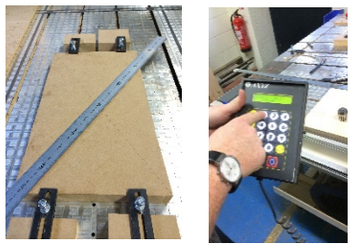


I then opened the document on ArtCam, the software that is compatible with the AXYZ. I then had to measure what piece of wood I was working on.

When I had sized down my design to fit to my desired piece of wood I then selected the roughing and finishing tools on the computer. I chose a 12mm for both roughing and finishing so it was quicker (as it is only a pra



I then set up the piece of wood onto the AXYZ, where I fitted pieces of metal and clamps which held the piece of MDF in place during the operation. I am using MDF because it is a cheap material suitable for practicing techniques.

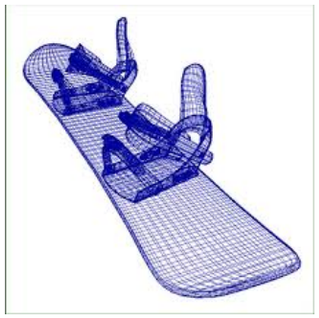


I then had to draw two lines that crossed diagonally the piece of wood to find the centre, where I would set up my X and Y axis. I finally added the 12mm tool the piece was being cut out with and started the cutting.

This was the result. When making the final snowboard I will have to machine it on both sides, therefore this same process would be repeated flipping the piece around.

This technique has helped me figure out how to design a snowboard so it can properly fulfil its function, for example (on the picture on the right) I have found out that there is no curve from heels to toes in a board. Moreover the sizing of the snowboard is now also clearer to me (also thanks to the anthropometric data collected earlier).

With this technique I also realised that wasn’t the way I was going to manufacture a snowboard, as, if you cut it out from a block with the curve already, it looses strength and might crack and break, therefore I will cut out a tapered (thinner at both tips and thicker in the centre) flat piece of wood to then bend it with a vacuum bag so it becomes a lot stronger but still flexible.



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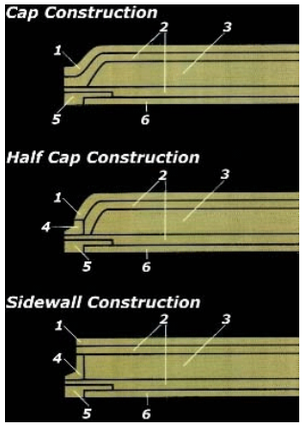
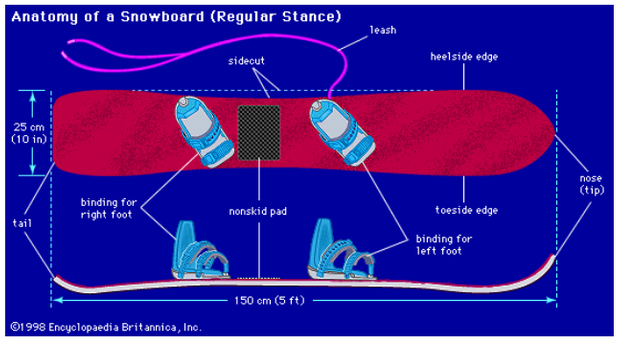
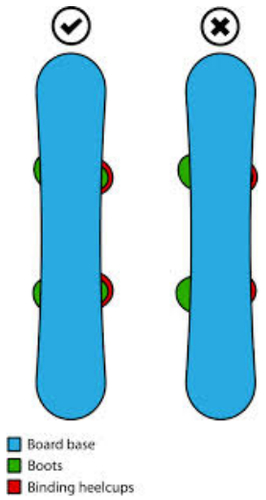
Ongoing Research



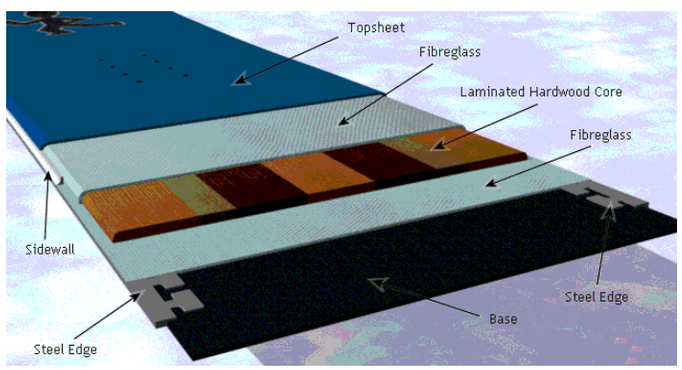
In order to actually understand how to make a snowboard and all of its special and specific features I had to research online a lot and attempt to gain communication with snowboard companies.

The photos shown below and to the left helped me very much to understand how the different types of construction for the sidewall and the edges of the board.



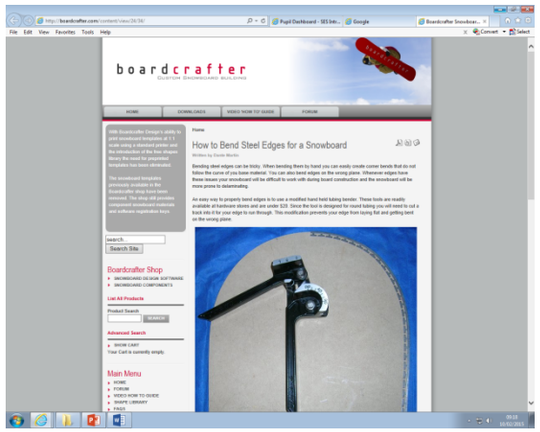


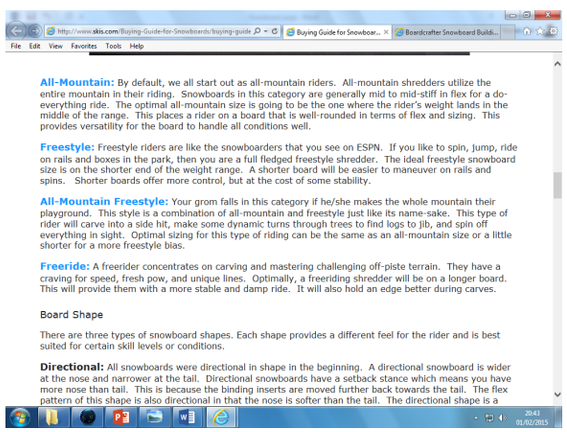
Other pictures which I found on the internet also helped me figure out the sizes of the snowboard, as well as using the anthropometric data, to make sure all the sizes would fit the interfaces perfectly.

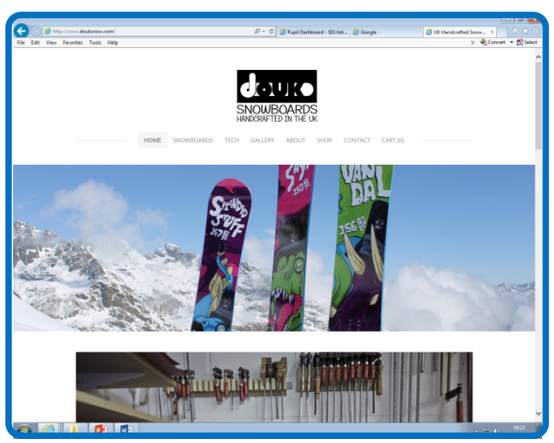


Finally, this picture which I also found on the internet, really helped me to figure out which materials I needed, as it showed clearly the different layers of a board, and this helped me be able to search for the right materials.

I also researched many videos on YouTube and webpages where some people would post tips when building a snowboard, or even tutorials. I learnt the essence of the making through these webpages, and then I was able to find a company, Douk snowboards, near my school, which I was able to visit to learn more about the making of snowboards.







Douk snowboards webpage.

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Ongoing Research

In order to fully understand how I was going to make this board I realised I had to see exactly how it was done as an explanation at a surf shop and videos weren't enough. I therefore contacted a local snowboard factory in England, called Douk snowboards, and visited their factory for an afternoon.

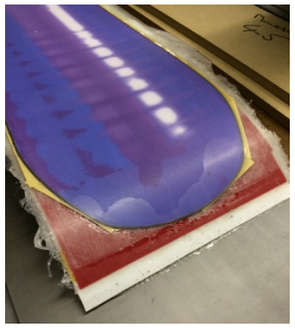
They, very joyfully, went through the whole process of making a board with me, as well as offering to be a source for the more specific materials needed in a snowboard which I couldn't reach in such small amounts.

The first thing they did in the process was to create the top and bottom sheets with the graphics, by a process of sublimation. As there is special equipment needed in this process I will have to send my designs to their factory so they print them for me.

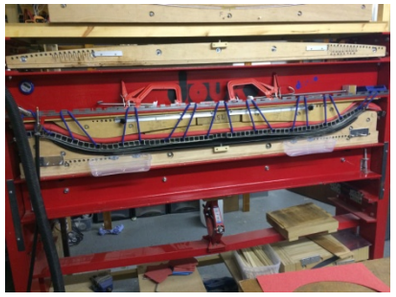
Then, they prepare the wood cores. They do this by layering various blocks of poplar and ash in some cases, to build special strengths. They cut them out into sheets and into the shapes of boards and then taper them so it is thinner at the tip and tail of the board.

They then finish the preparation of the board by adding the sidewalls on both sides of the board (plastic protectors) and a tail and nose protector. Finally they add the holes for the bindings and insert them. They stick everything together with hot glue because it is temporary as it will become properly stuck when it is pressed together with the epoxy mix.

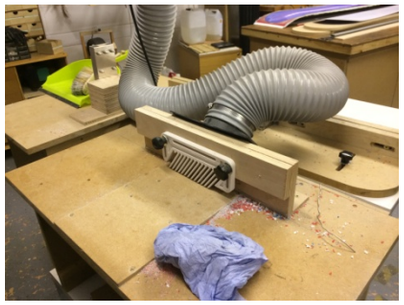
Once the core is ready the steel edges are bent into shape so that everything is ready for layering. The biaxal and triaxal fibreglass is prepared and cut into shape and, if needed for extra stiffness. Carbon strips are strategically positioned on the board. There is also a piece of rubber placed between the steel edge and the core simply for extra protection.



The steel edge is stuck to the bottom sheet using super glue and clips to keep it in place at all times. Then, the epoxy mix is prepared and everything is soaked up with a spread out layer of epoxy mix, and it is done gradually from the bottom to the top (ie. The bottom sheet is soaked first, then the GRP layer, then the core, etc). It is crucial to make sure that the top sheet, the core and the bottom sheet are lined up.



As I am not experienced, they recommended me to use a long curing epoxy mix, so I have more time to place it all perfectly before it starts sticking. Then, finally it is all put in a pressing machine, these apply lots of pressure and shape the board into the curve desired, and I will recreate that pressure using a vacuum bag and a former, as I don't have that type of machinery.



The board is let to rest in the vacuum bag for 24 hours, and once it comes out the excess pieces are cut off with a ban saw following the path of the steel edge. Then, an angle is cut out on the sides of the board so that the sidewall has an angle instead of being vertical and so the steel edge contacts first with the snow.

The final step is to grind and wax the bottom sheet of the board and also grind the steel edges; dig the holes through the top sheet into the bindings, and the board is finally ready for use.

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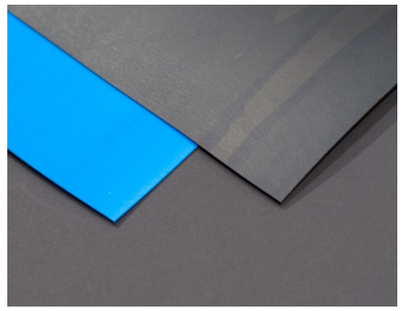
Additional Components Selected

These are the binding rails which attach the board to the bindings, with a screw attaching it. It is crucial to analyze this properly as the slot on the board must fit this piece.

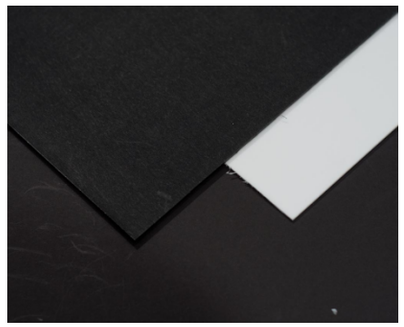
This is the channel plug. It is simply a stopper to prevent the binding rails to slide out. It also protects the user from sharp edges from the metal binding system.

This is a binding I bought from Burton, which I analyzed to understand how to design my board around it. This is what connects the board to the boot therefore it is a key component needed. It uses the special channel technology which allows the bindings to be placed at several angles.

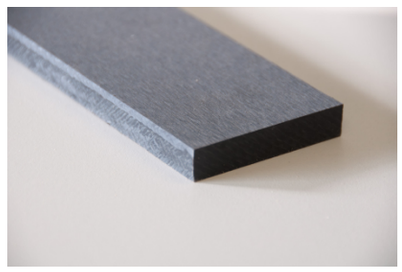
Statement of Chosen Material



The base material is made out of a P-Tex plastic. It is a specific material which will melt the snow below it to allow it to slide downwards. It can be printed on using a process of sublimation to create graphics. I will get it from a local source to lower the environmental impacts.



These are the tip and tail spacing materials (made out of a technical plastic). They are used to protect the tip and tail of the wooden core from any moisture or water from the snow.



This is a phenolic sidewall material. It is a very hard plastic which provides protection for the sides of the wooden core, and it bonds very bell with it. This is a specific material used to produce professional snowboards.

These are steel edges which are stuck onto the base of the snowboard and they are the ones that cause friction with the snow, therefore they are made out of steel as it is a waterproof and very strong material. It also protects the board from cracking if a rock is hit when snowboarding.

This is biaxial fibreglass. It is sowed in crosses and I have chosen this material because it enables the board to have a greater level of flexibility. I will also source it from a local shop to reduce the environmental impacts of transport when sending it.

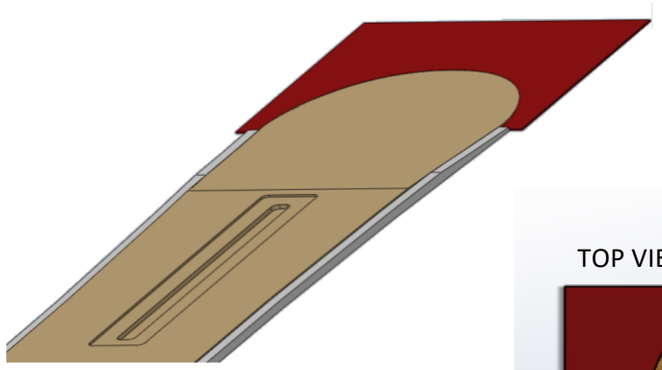
I will use aluminium to make the binding systems. This is because it is a strong metal, which is also quite light and robust, not making the board too heavy, therefore not adding a lot of weight to the snowboard but still being very robust. It is not very expensive either and can be machined easily.

One of the greatest advantages of MDF is its low cost. Since it is made from all kinds of wood it can be manufactured in bulk therefore the cost of purchasing it is low. MDF is also sustainable as it is made of recycled wood. These are the reasons why I will make my formers out of this material.

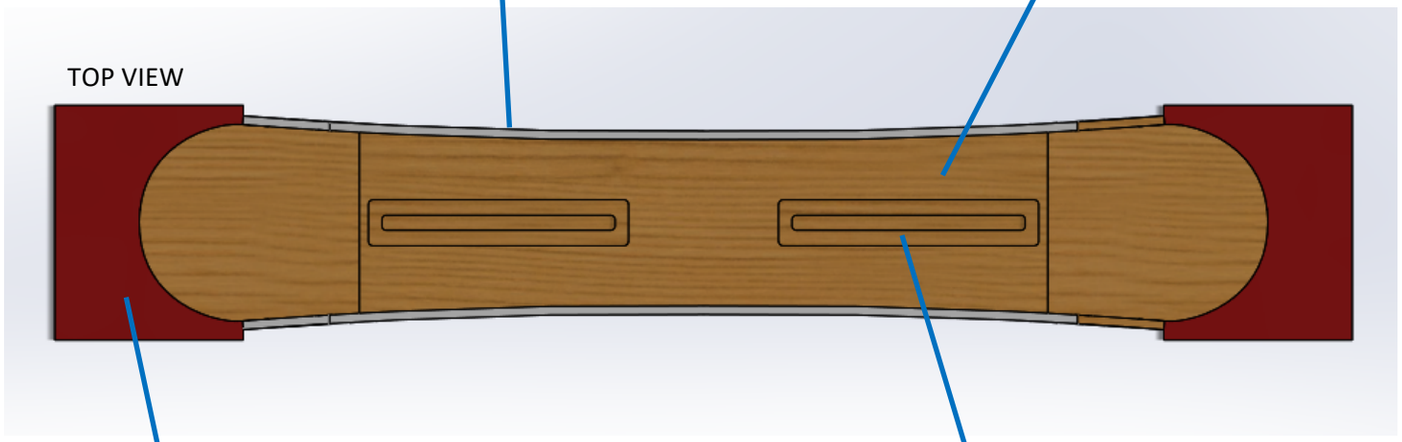
Poplar is a fast growing Hardwood sourced from the United States. It is not listed as a threatened species of wood therefore it's sustainable. It is also a moderately durable wood, and when stranded it gains lots of strength. This is why I will use this wood to make the core of my board.

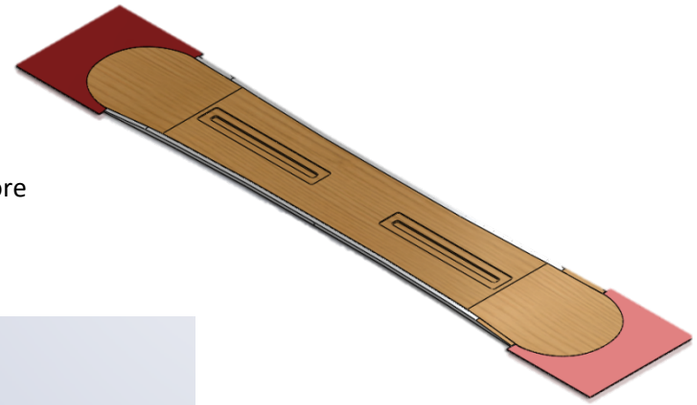
Final Rendered Design

Final Design:



TIP/TAIL CLOSE UP

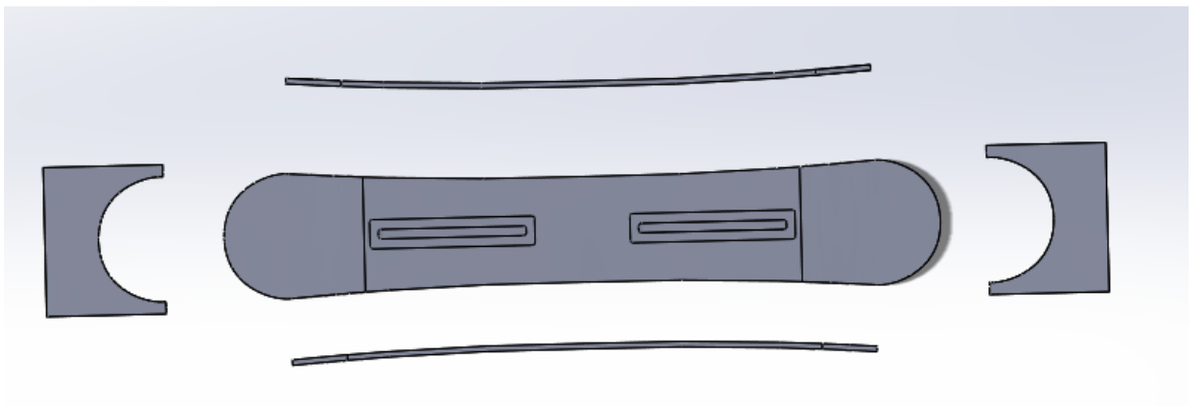


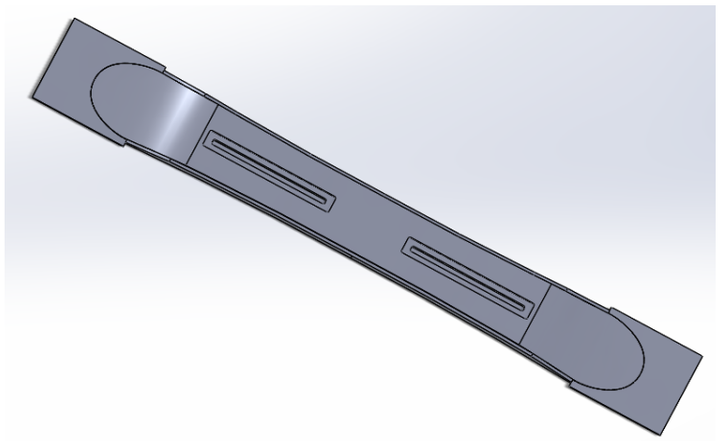


3/4 VIEW OF THE BOARD

PROFILE OF THE BOARD

Assembly and Exploded View:



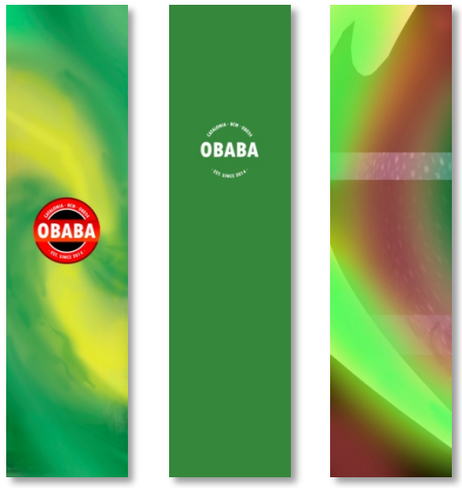


Ongoing Research and Graphics Design

The Final choices

As the snowboard has graphic designs on the top and bottom sheet I decided to design my own so it is more greatly appealing to my target market. To do this I decided to come up with a name for a brand in case the board was to be mass produced.

To design my final graphics I based myself on an pop artist: Madsteez. He uses a very wide range of colours which are very live, so I chose to design my board in his style so that it stands out, and so it is also more appealing to my target market



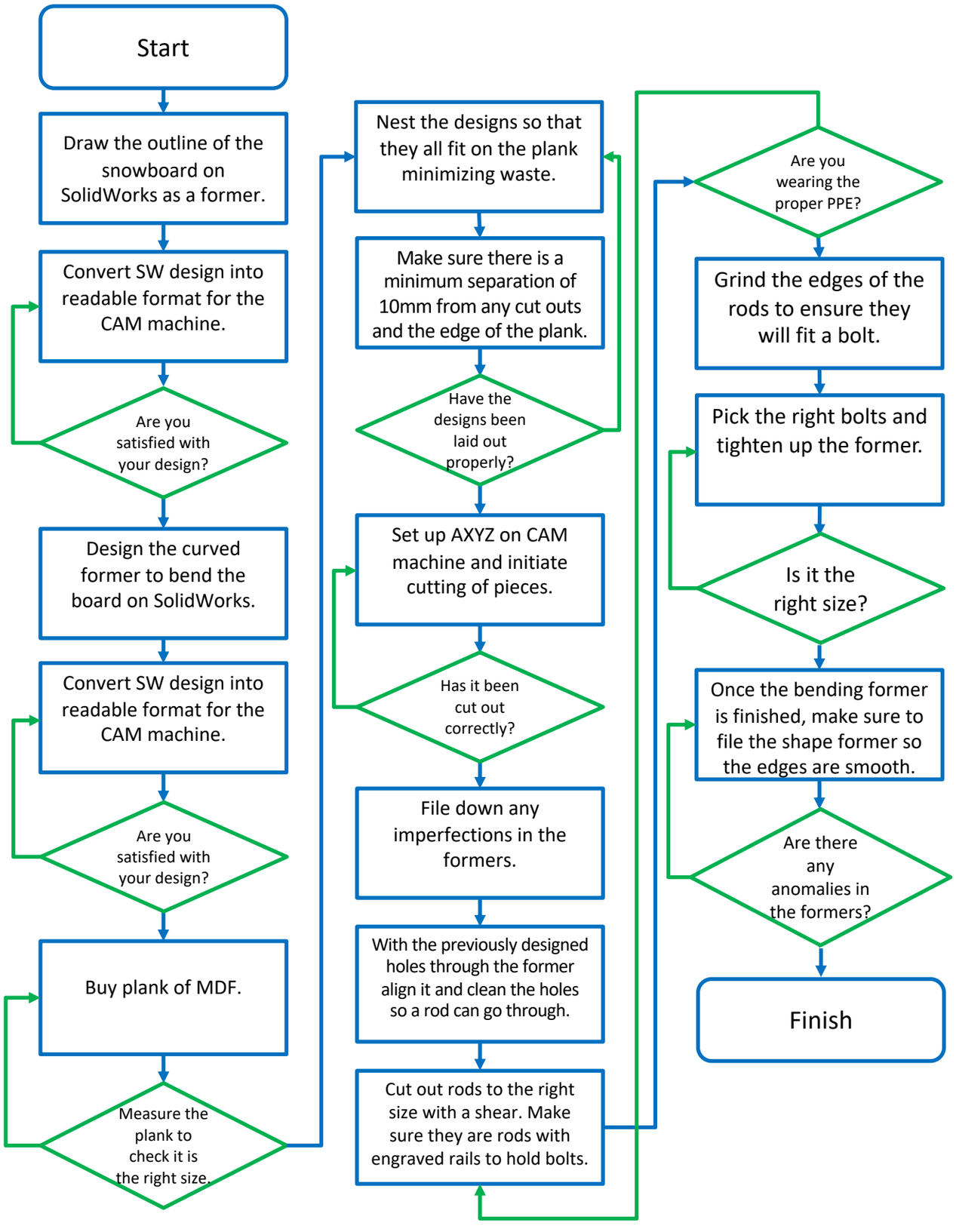
Other Bottom sheet experiments

What it would look like when printed through sublimation at the Douk factory.

Other Top Sheet experiments

Production Flowchart 1

Process 1 (making formers)



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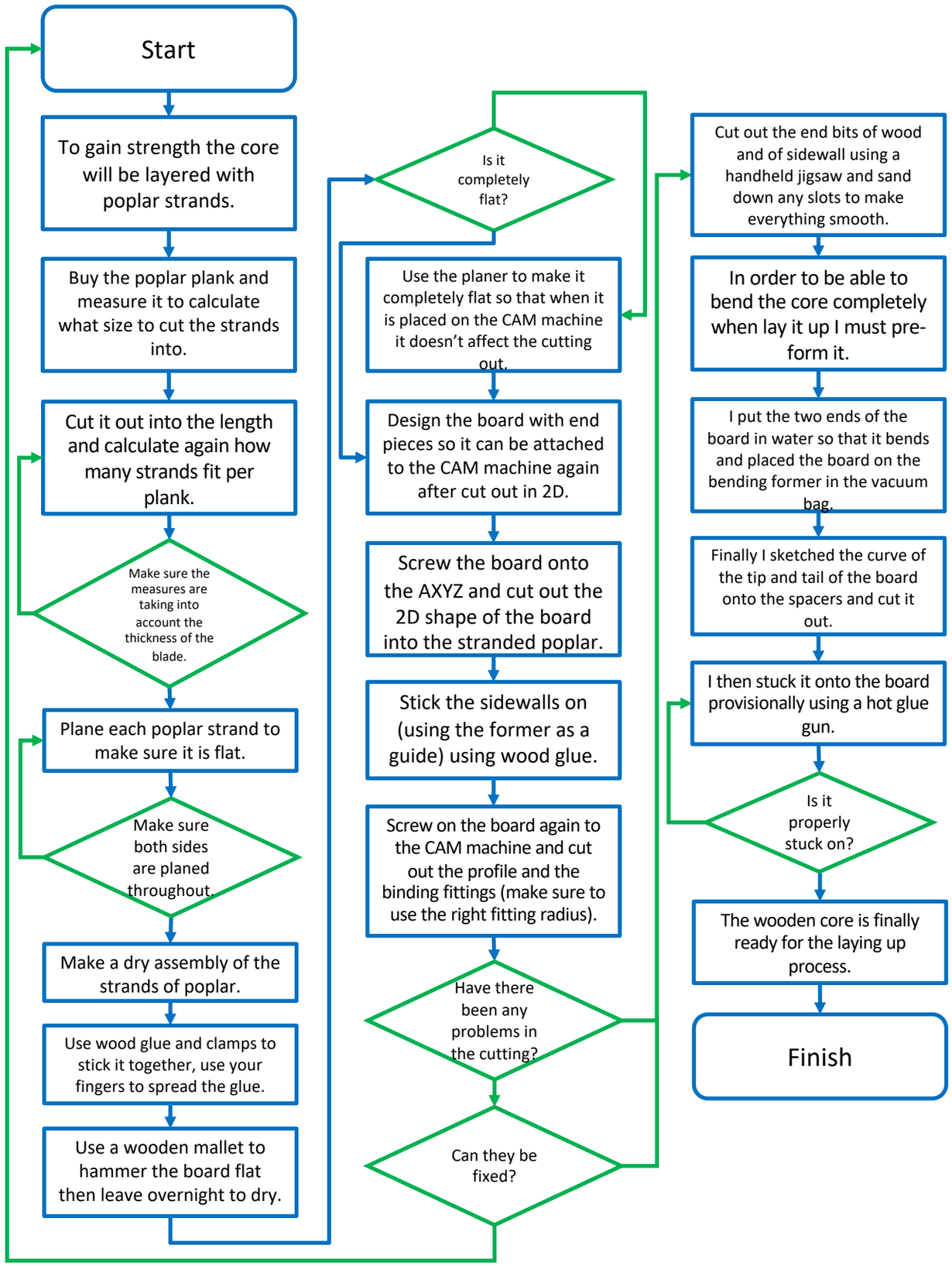
Production Flowcharts 2

Process 2 (preparing wooden core)



Process 3 (laying up processes)

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Production Details

Process	Detailed description, naming all tools and equipment.	Quality Control Measure needed	Safety Issues discussed
Check materials and designs	When receiving materials make sure there are no blemishes or imperfections which could lower the performance of the board once it is finished. Checking the designs so they are exactly what wanted so it can follow our design criterion.	If the materials have imperfections of any way they will have to be replaced; and if the designs are wrong they will have to be re-drawn.	When carrying wood we have to be careful it doesn't knock with anything and become damaged.
Marking out	When using 2D design to cut out the several pieces I will have to nest my designs to minimize the waste and so the designs are within the parameters of the sheet of wood. I will also have to place the X and Y points correctly on the CAM machine.	If the wood isn't placed correctly on the CAM machine some pieces will be cut out incorrectly meaning that the board as a whole won't work.	When setting up the CAM machine, ensure the drill bit is out the way, and when adjusting the drill make sure you don't damage the end because it will be expensive to replace.
Measuring	I will have to calculate how to cut out bits of wood in order to be able to make something a certain size.	Using a ruler to make sure that I can fit a design within a plank. If it doesn't fit more wood will have to be ordered. If it does fit and there is extra space things such as wood knots can be avoided.	When measuring the pieces of wood we have to make sure we don't damage them or draw on them too much in a place where will be seen because it might be expensive and difficult to fix.
Using machinery	When using cutting, drilling or even CAM machinery make sure that the measurements can apply to them, for example, when cutting off pieces of wood using the band saw some of it will be consumed by the machine.	Measuring the blade with a ruler so that we can use those measurements when calculating how to spread out the sizes on the board.	When measuring the blades or drills I have to be very careful in handling them and avoid touching them as much as possible as they will cut through my skin.
Wearing PPE	Wearing Personal Protective Equipment at all times is essential when protecting the clothes we are wearing and ourselves.	Wearing the right PPE at the right time will be essential as it will protect the zones of our body which are in danger at the right time when using certain machines.	I should wear goggles at all times in the workshop to protect my eyes from anything that could jump into them, and I shall also wear a dustcover to protect my clothes. Gloves etc might be worn when handling hot metals or other things.
Evaluating processes	Once I have stuck something in I shall evaluate if the bond is strong enough, for example, so I will need to check for errors and fix them if there are any present. This is to ensure the design is properly done so I can carry on with the construction.	To check on every side for errors and to apply a small force in trying to separate two things to see if the bonding has been correctly done.	When testing my product I have to be very careful as I don't want it to break. Also PPE must be worn when carrying out this process to protect myself as well.
Evaluating a design	To ensure that when I design a component to be printed/cut it is the right size and we will not waste the material I have to nest it correctly leaving the minimum space of the drill's thickness between two lines and this will then have to match other components so that when I assemble it, it will come together perfectly.	Checking on the computer monitor before starting the cut that it is all perfectly in place to avoid any problems. If something is cut out incorrectly on the CAM machine it will mean that the board as a whole won't work.	When checking it is all in the right place before cutting I have to be careful with touching the blade. Also wearing the correct PPE once the CAM machine is started.

Construction Diary

Quality control measures

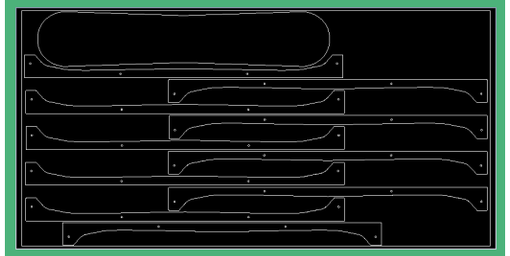
Normal procedures

Process 1 (making formers)

1

The first step to be carried out was to get all the measurements from the plank of MDF.

2



Once I had all the measurements of the plank I could plot my design onto a 2D Design plate of that size. I then nested the designs with a minimum separation of 12mm between each bit so that I could fit both formers on the same plank minimising the consumption of wood.

3

I then set up the axis on the CAM machine and initiated the cutting of the formers.

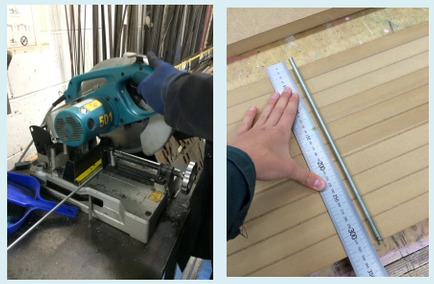
4

Once they had been cut out I had to measure them and compare them to the designs to make sure they were the right size. I did this with a measuring tape.

5

In order to put the bending former together I had designed holes through each piece so that they could simply be put together with a rod and bolts. I therefore lined up the holes in a dry assembly.

6



Using the measurement of the former I cut out the rods using a *** so that they were slightly wider in order to fit the bolts at both ends (I left and extra 20mm for both bolts.

7

So that the bolts would screw onto the rods easily I had to file the rods using a ***. This would also ensure a very tight pressure and hold.

8

I then go the corresponding M8 bolts and using two *** I tightened the bolts equally on both sides to finally put together the bending former.

POL BERNAT BELENGUER

Construction Diary

Safety control measures

Normal procedures

Process 2 (preparing wooden core)

9

In order to make sure I would be able to fit all of the strands within the plank of poplar I had purchased I had to measure it and mark it first. I did this whilst trying to avoid any weaker spots within the wood. This would save me posterior work.

10

When cutting the strands out with the *** it was important to take into account the thickness of the blade as that would also consume a section of the plank.

11

I made sure I had the right measurements (width and length) by measuring again the wood. I have repeated this, again, to make sure my calculations and previous measurements had no mistakes.

12

I then used the planer to cut off very thin layers at the top and bottom of each strand. I did this to make sure the board would be completely flat when stuck altogether.

13

This is the handle in the planer which would be used to set up the height of the cutter, to vary the depth of the cut. When doing the strands I would only change the height once I had done all of the sides of each strand in the whole set, this was to ensure they were all the exact same height.

14

I used a pencil to show which side I had put through the planer first. This was to ensure there would be no confusion.

15

I then made a dry assembly of the board using clamps. I had to make sure that the grain was in a zigzag shape (/ \ / \ ). This was to ensure that the core was kept flat and didn't blow when sticking in.

16

I then opened the clamps slightly and started placing wood glue with my finger on every side of each strand to ensure a strong bond. I used the wood glue Titebond for this job. I then tightened the clamps and left it to dry.

Construction Diary

Safety control measures

Normal procedures

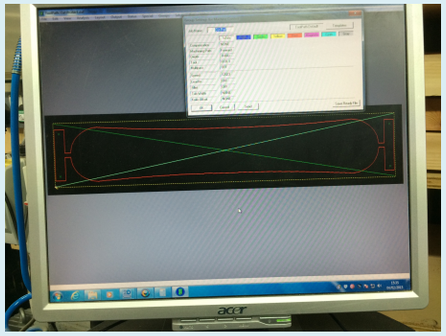
17

To make sure that it was going to be completely flat I used a mallet, whilst it was wet, to try and smash pieces sticking out into place. I then started noticing that it was blowing too much so I put the board to dry in a press so it had additional pressure downwards.

18

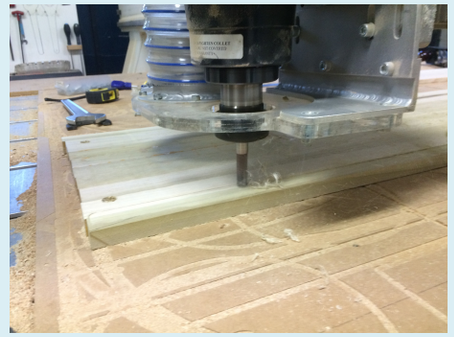
This is what the strands stuck together looked like. I noticed that there were bits of glue sticking out on the board which made it slightly uneven. I was going to machine it in the AXYZ CAM router so I wanted to ensure that I had one flat side, so I put it through the planer once again.

19



I then designed and loaded up the shape of the board onto the CAD programme working with the CAM machine to cut out the 2D shape. I designed some end bits which would be cut off in later stages so that I could screw the board back on after when profiling it.

20

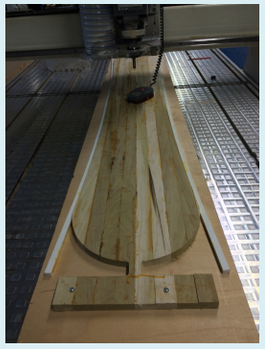


I firstly held the board in place and machined the holes where the screws would go, this was to ensure that it would be within the end bits in the design. I then screwed on the board, set up the axis on the CAM machine and initiated the cutting with my finger on the stop button just in case something went unexpectedly.

21

Once the 2D shape was cut out I filed it down to make it smooth and used the MDF former as a guide to stick on the sidewalls (white plastic bits) using the Titebond glue. I left it to dry in such a position so that the pressure of the clamps as well as gravity acted on the pieces.

22



I then screwed the board again onto the CAM machine to profile it. I set up the axis and made sure that I was cutting on the side which I hadn't previously planed so that the bottom would be a flat surface and now both sides of the board would be smooth.

23

There was a problem during the cutting as the end pieces of the sidewalls moved slightly when profiling them causing some of it to be cut strangely and affecting the shape of the end of the core. However this was easily fixed as I filed down any uneven bits sticking out and cut off the end pieces of the sidewall using a hand-held jigsaw. I then also cut off the end bits on the board.

24

Once the board was perfectly smooth I filled a large bucket with water and wet both ends of the board for around 5 minutes each. This was simply to get them to bend further.

Construction Diary

Safety control measures

Normal procedures

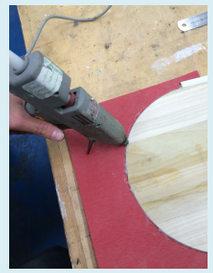
25

I then set up the former in the vacuum bag and put the board on the bending former. I then applied pressure onto the board when air was being taken out of the bag to ensure that the board go the full bend on the former. This was simply a process to pre-bend the core so that it would be easier to fully bend it when it was all laid up.

26

I then used the tip and a marker to sketch the curve onto the tip/tail spacers. I would then use that guide to cut it out using a pair of scissors.

27



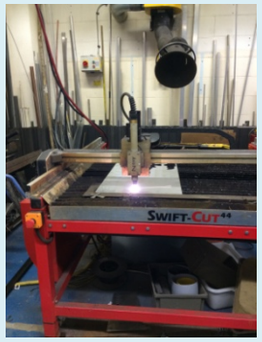
Once I had cut it out I stuck the pieces onto the board using a hot glue gun. This is because only a provisional bond is needed before the epoxy. I had to make sure there were no places without fillings of glue as it didn't come off during the stage of laying up.

28

The end bits of the tip and tail spacers were cut off so that they fit in the former. Finally the board was finished and ready for laying up.

Process 3 (laying up processes)

29

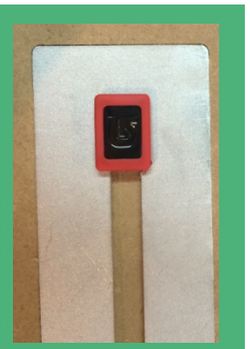


Firstly, before laying up, I had to cut out the channel binding plates on the Plasma Cutter so that I could fit them into the core when putting the board together: so that the bindings can be attached. I decided to cut it out of Aluminium as it is light and strong.

30

Once I had cut it out I used a file to profile it perfectly and to make it fully flat so that it fit perfectly in the slot in the core. I then sandblasted one of the sides so that it had a stronger bond when sticking to the rest of the board.

31



Finally, before deciding I was going to use those plates I had to measure them and test them with my interfaces to make sure they fit exactly where I wanted them to.

32

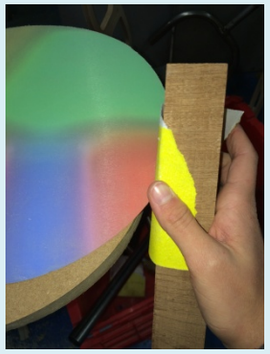
After that I had to prepare the P-Tex base for the laying up. I had to cut it out using a hand-held router following the path of my former. I had to make sure I was wearing PPT (Personal Protective Equipment) during this procedure as lots of material was chipping off.

Construction Diary

Safety control measures

Normal procedures

33



Once I had cut it out I realised that the base had moved during the procedure, therefore I had to sand the excess bits off to make it a smooth shape again.

34

Yet again, before using what I had just produced I had to measure it to make sure I was following my plan and that everything would fit together.

35

I then had to stick the steel edge onto the base, which I had just cut out, as it will create the grip to the snow when riding the board. To do this I pre-formed the steel edge around the former using clamps.

36

I then realised I had caused the end of the steel edge to be at one of the sides instead of the tip or the tail. I had to change that as that is where the snow will contact the board to make it turn and it would affect the riding experience.

37

Finally, I placed the base under the edge and, whilst holding it on the former, I glued it together using super glue (as it is provisional because the epoxy would put it all together at the end).

38

To prep for the laying up I then got hold of the fibreglass sheets and cut them to size using textile scissors. I had to make sure the sheets weren't too wide as they could overlap and stick to the bottom of the board.

39

I then cut up some carbon strips to add extra strength to the board. I measured them so that they fit the board properly.

40

Finally, after getting hold of my top sheet, I had all my layers ready for the board and I made a dry assembly to understand what it would be like when laying it up.

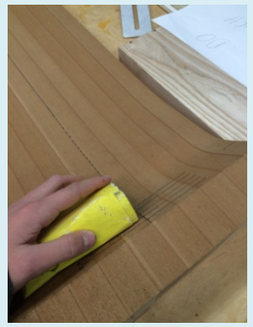
Safety control measures

Normal procedures

41

I then drew a scale on the former to make sure I could line everything up when laying it and to minimize the error.

42



And, to proof the former from the epoxy and to prevent the board from sticking to it I had to sand it down several times and soak it with layers of Release Agent and Beeswax, which would make it impermeable and impossible to bond using epoxy.

43

Finally, this was the last step before laying everything up, and it was painting the channel system slots with a varnish to ensure it was impermeable so that if snow went in when snowboarding it wouldn't reach the wooden core and make it rot.

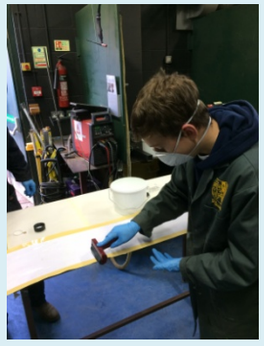
44

I then got all of my paintbrushes and rollers together on two protected tables, one with the former on it and the other one with the layers and the epoxy. I had to make sure I was wearing a mask as the epoxy is slightly toxic and bad if is inhaled during a long period of time.

45

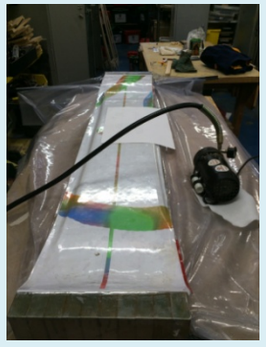
I then had to mix the epoxy hardener and the epoxy resin using a measuring cup as it had to be mixed to a special rate (10:4) or it would not bond properly.

46



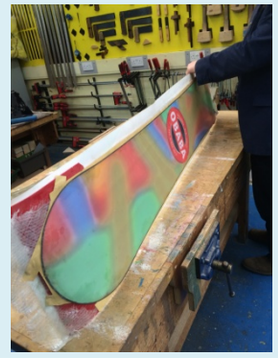
I then had to soak each layer up with the mix. It was also very important to make sure that the epoxy was evenly spread so that everything was correctly put together.

47



I then placed each layer in the right order on the former and in the vacuum bag. I left it forming overnight for 24 hours to make sure the epoxy had cured properly.

48



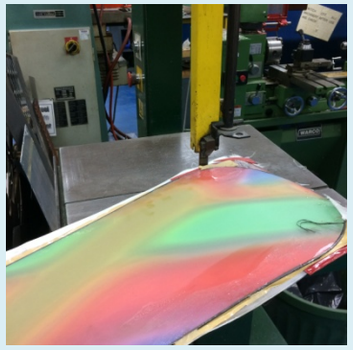
I then took off the board from the former and the vacuum bag using a screwdriver to separate them both through leverage.

Construction Diary

Safety control measures

Normal procedures

49

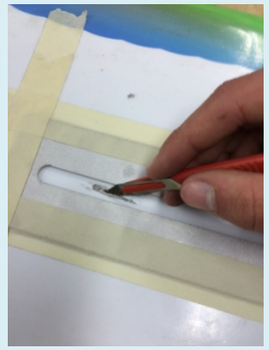


I then cut off all of the excess around the board using a band saw and following the steel edge, which the saw couldn't cut.

50

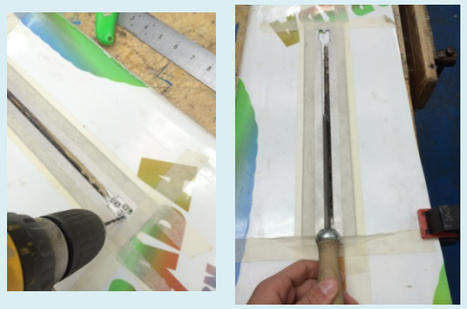
Once it was all cut out I found out there were some gaps in the board as I hadn't centred the wooden core properly. Therefore I had to fill up. I tested a car filler however I decided to use Epoxy mix with micro-balloons as it was stronger and more flexible.. Then sanded it down to shape.

51



I then had to open up the channels where the bindings would go. I decided to use a scalpel, however it was very complicated as I could exactly measure where the hole was as the core wasn't centred.

52



I then decided that the scalpel wasn't working efficiently as it was taking too long, so I started using a drill to find the path and then followed it using a file to sand it down properly. I repeated this process for both binding sites.

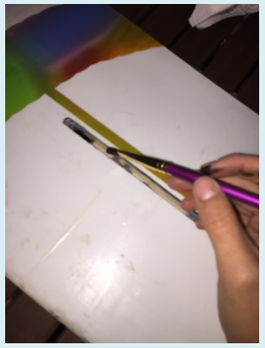
53

To make sure I had done the right job I used a ruler and the interfaces to try and fit them inside, and they fit, which meant that I could go on to the next step.

54

I reached a point in the project where I didn't have the machines or resources to make it have a professional finish, so I had to take it to a professional shop where they grinded, filled and waxed the base of the board so it could be ridden properly on the snow.

55



Once I got it back, I painted the slots in the channel with an oil based paint to make it impermeable. I had to repeat this process as most of it came off when I had been using the file and drill in opening the channels up.

56

Finally, I was able to pull a transparent layer off the top of the board (which had been protecting it from the epoxy fillings, paint etc) and it was ready to use.

Safety control measures

Normal procedures

57 And, after installing the bindings, the board was finished.

Testing and Evaluation

In Use Testing

I then took the board to the mountain slopes and tested it there.

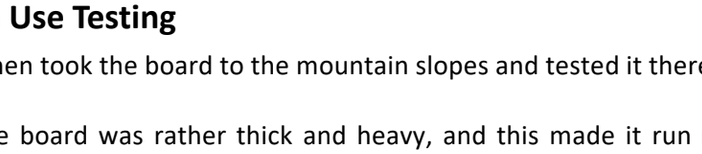
The board was rather thick and heavy, and this made it run much faster, however it was also slightly more difficult to control it and it also meant that you couldn't use it for jumping or going off-piste on the powder snow as it would be slightly more difficult to raise the nose of the board off the snow.

However, for the rest the board met its targets as it could be ridden properly and, due to the various layers of fibreglass used and the carbon fibre strips, it was also fully durable and would be able to be ridden sensibly for long times without it breaking or cracking.

User Reaction

When I gave my user tested the product they found it very aesthetically pleasing and said that the designs were very attractive. They also found the Burton channel technology implemented very useful as it meant that they could adjust the board to a personal level and more freely.

However, the one criticism was that the board was too thick and this meant that the board couldn't be ridden properly in all terrains.



Workbench Testing

As a final check to make sure that everything was in the right place and the right size I measured again the length and width of the board and made sure the board had the right curve on it by using a spirit level.

I attached the bindings onto the board once again to make sure they fit on correctly and that everything was the right size to ensure the durable use of the board in the future.

Evaluation Against Design Criteria

CRITERION TYPE	EVALUATION BASED ON TESTING	PASS OR FAIL
Function	The board is able to be ridden in multiple styles.	✓
Style (Anthropometrics)	The board is 152cm long and 24-29cm wide, therefore it's within the bounds I defined as my criterion earlier.	✓
Ease of Use (Ergonomics)	The board is easily used, however it's too stiff to use it to jump.	✗
Safety	The board is completely safe to use.	✓
Market	The board is good quality and expensive within the bounds defined.	✓
Material Characteristic	All the specific materials usually used have been used.	✓
Weight	The board is slightly heavier than usual, but it also means it can ride faster.	✓/✗
Stability	The board is completely stable and is to be ridden on all kinds of snow.	✓
Durability	The board is able to withstand years of using it.	✓
Costing (Economic)	I used poplar instead of a manufactured wood for the core as it is more durable.	✗
Social issues	The design of the board is simple and respectful in all means.	✓
Moral issues	I sourced all the materials used from local responsible sources.	✓
Env. Issues	The minimum amount of waste has been produced and it has all been disposed responsibly.	✓
Sustainability	Poplar is a softwood which grows quickly. I had to use plastics which are a non-sustainable material.	✓/✗

Modifications indicated by Commercial Production

In order to commercialise the product the building of the board must be more efficient, where the time spent in production is minimized as well as cost (still taking into account social, moral and environmental issues). To do this different changes can be made in the construction line.

Firstly, I would produce cores, would form them, and carry out other steps on separate weeks in order to produce a set batch of boards at once. For example, the first week I would make the wooden cores, the second I would bend steel edges and prep all layers and, finally in the last week I would form all of the boards.

When bonding all of the layers of the board together using epoxy I will use a press rather than a vacuum bag and a former. This is because it can apply a lot more pressure onto the board to shape it exactly to the shape wanted. It is also a muck quicker process, lasting less than an hour usually, which makes it much more efficient.

I will also use automated machines which will cut the board up into strands and profile them flat automatically. This will help me save time, but due to the complexity when gluing the pieces together machines won't fully take over all jobs for humans, which means it will be more socially correct (as I am still employing people).

Moreover, I could use a shorter time curing epoxy resin mix so that the bonding process would be faster and it could spend less time in the press, making the process more cost-efficient.

Finally, I could also use a jig to cut out the binding slots which would enable me to produce a batch of boards quickly without variation and quickly.

Modifications indicated by User Reaction

My user's main reaction towards the board was that it was rather heavy and thick to use it in jumps; this would be easily fixed, simply by profiling the board lower and making it thinner when in the CNC router, however in mass production or in the production of a large batch different thicknesses of the board could be manufactured to fit different styles of snowboarding.

Another modification would be to simply centre the wooden core within the board so that the binding systems are centred and this doesn't affect the riding of the board. I would fix this by taking into account the width of the steel edge which I forgot when making this product, and this will also mean that the fillings with epoxy along the sides aren't needed.

Finally, the last criticism made by mu user was that the bend of the board was too little and it should have a greater curve at the nose and tail. This will be changed by using the other side of the former, so that pressure applies downwards only to make it easier to bend the whole way.

FINISHED PRODUCT

POL BERNAT BELENGUER