Design, Technology and Innovation
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Indian Institute Technology Delhi

Lecture-4
User Centred Helmet Design Part 2

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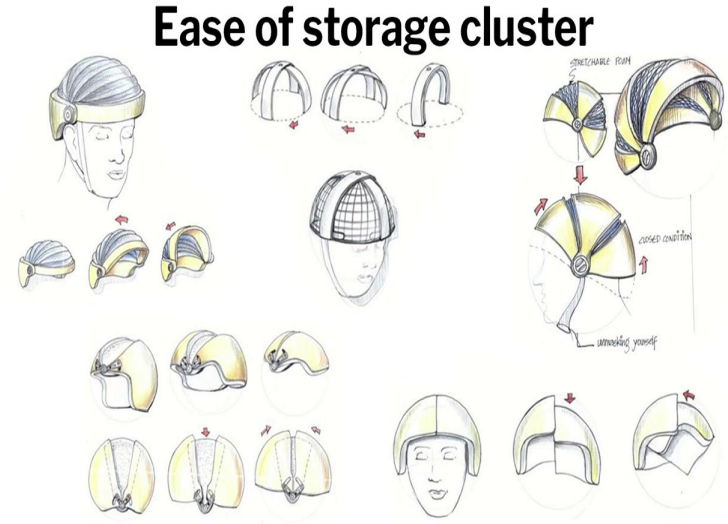

So look at the Ease of Storage cluster ideas. Remember these other ideas, you know, turning idea, the folding idea, the Greek helmet idea. In this, the students somehow selected , you know; the receding idea. Amalgamated these two and he did not take one idea together.

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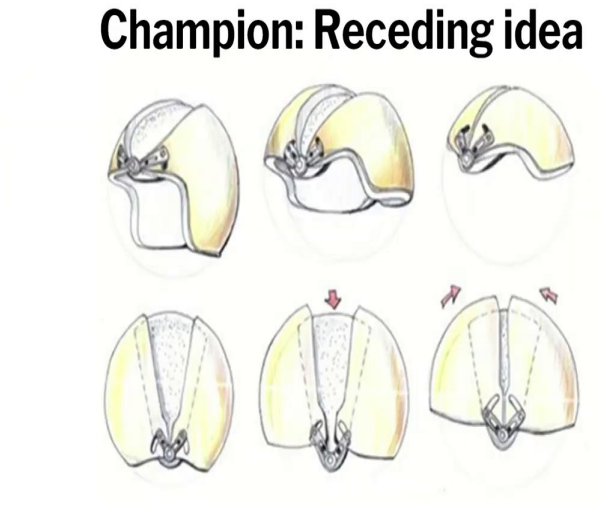

He said that I would like to make it very slim so he started with this which is part of the receding idea.

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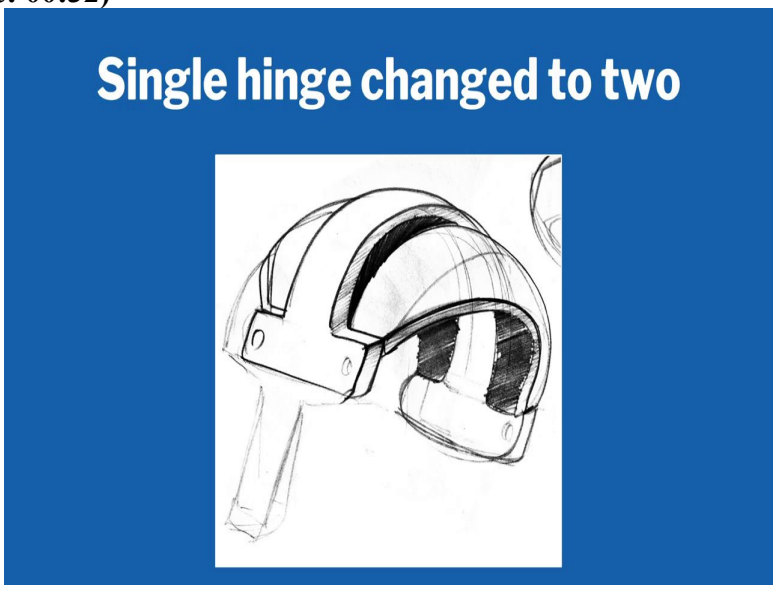

He choose that as a champion and then took it forward from here.

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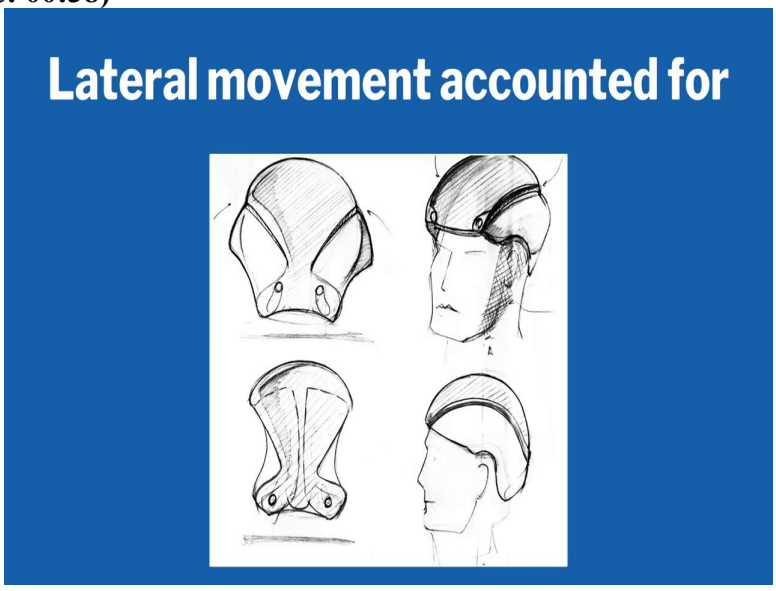

See, how did the ideas were developed by using other ideas putting together and then came up with this where you press and you push the both cells inside and it becomes very narrow. This is the Ease of Storage idea.

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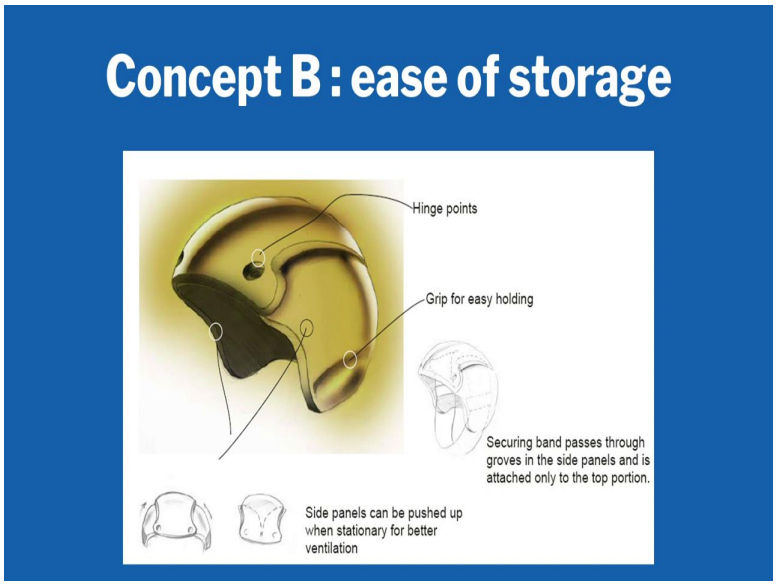

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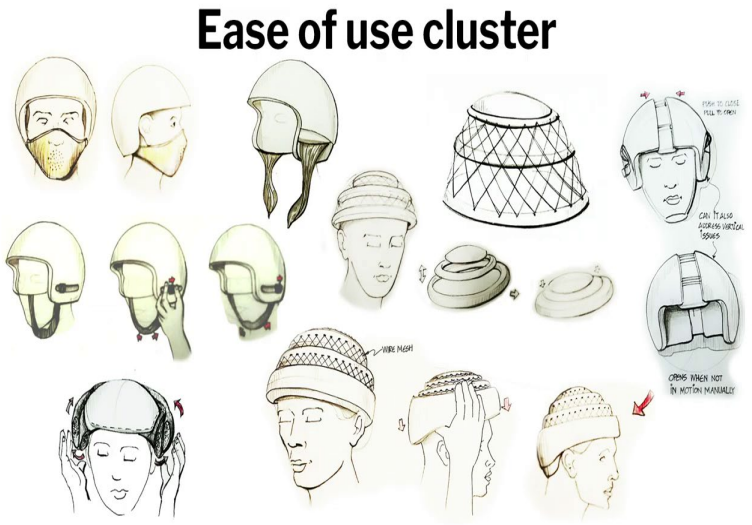

And then, comes the Ease of Use cluster. Remember the ideas. These ideas, those ideas, all put together and finally this was taken as a champion. This idea was taken as a champion because this has with, you just have to wear it as a cap and push it down. Right?

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It was much more easy to wear so that was considered as the main idea.

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So this further developed because the net is too large. There were a lot of gaps. It won't, you know, it won't be acceptable as a helmet.

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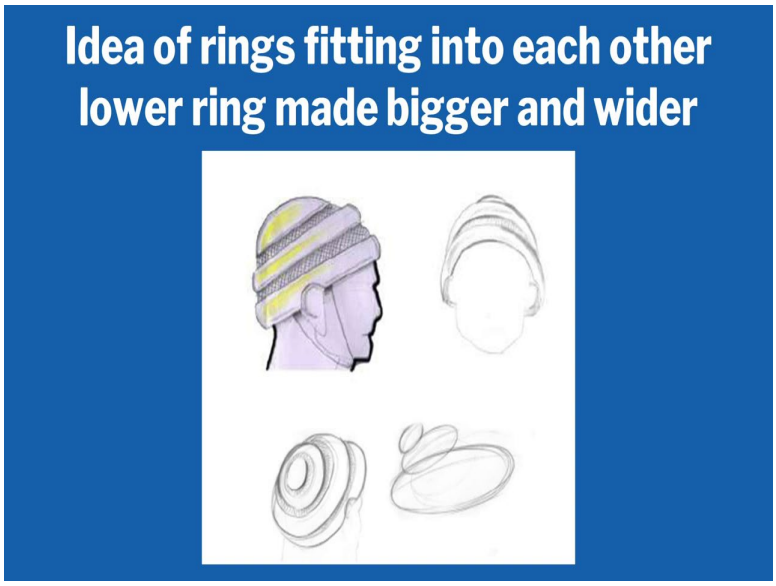

So those gaps were reduced and here you can see how the net is becoming smaller and helmet cells are becoming larger, but still that whole idea is going inside.

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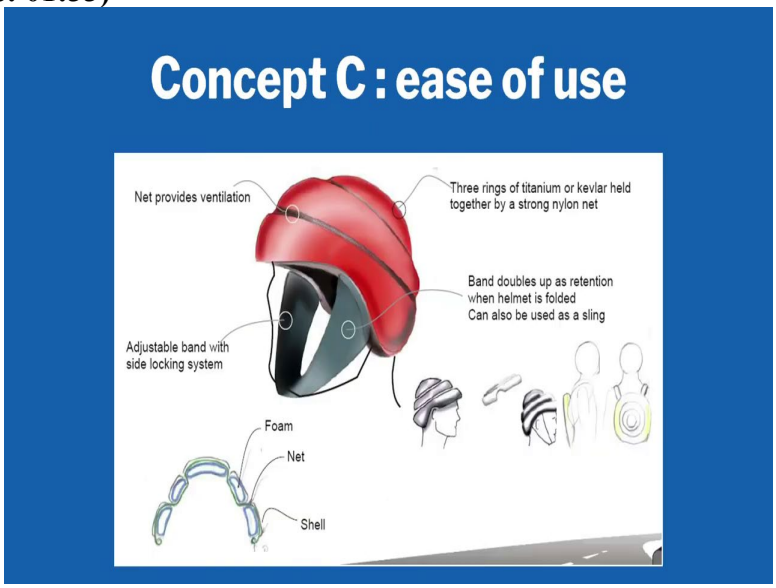

And finally you can see the concept building into a Concept C which is the use of Ease of Use. So you have 3 concepts.

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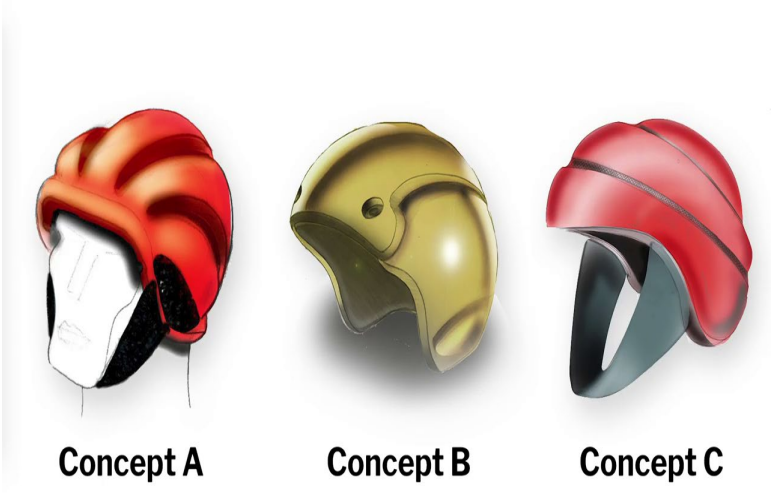

The competition between the Concepts is a very, very critical thing and from these three concepts now we need to find out which one will be used for the current product brief.

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Concept	Advantages	Disadvantages
	Good air circulation Multiple ways of gripping Light weight Strong style statement	No reduction in volume Difficult to manufacture in frp Rare chance of pierce injury Problem of dust
	Reduction in volume Ventilation on sides Easy to carry and hold	Moving parts add to complexity Projects a weak image
	Reduction in Volume Good ventilation all around	Three part manufacture Does not look robust Loose parts

The product brief was very, very clear. You would have encouragement of use. You should have, you know, basically good storage and you should have good ventilation also. So, all the three can have, all the three have three different degrees. Right? First one is very difficult to store, it is still large. Whereas this one it is easy to store. It is ventilatable also. This one is easy to store, it is ventillatable and easy to wear.

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So, automatically the last one got selected as the concept to go forward. And then we went to experts and asked them. 'What do you think about this helmet?' They said 'It's horrible'. Who would want to wear a helmet which is broken from the beginning. Isn't it an interesting perception? And this was the first reaction from the scientists and the engineers that it is like a broken helmet. You are designers should have the perception to make it look strong and not broken.

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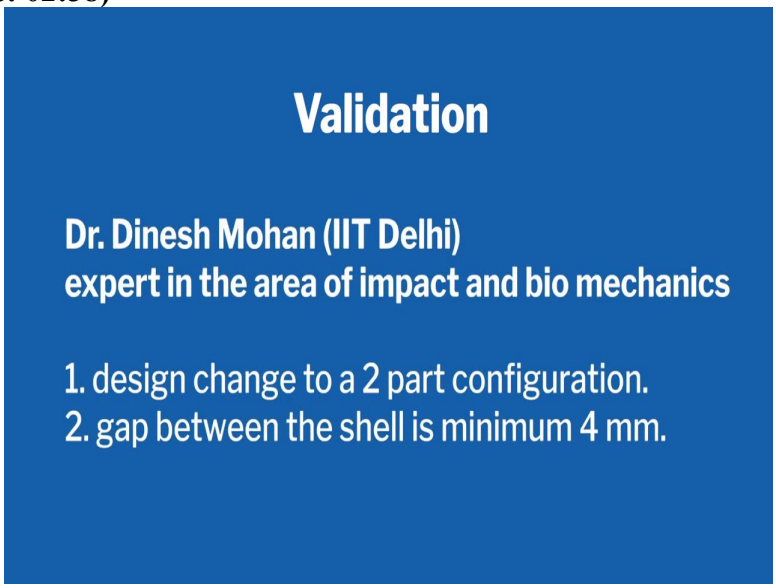

So then then, you know, Dr. *Dinesh Mohan*, again a professor, said 'This is not going to work. At least make it two parts receding then the, you know, we reworked the whole design.

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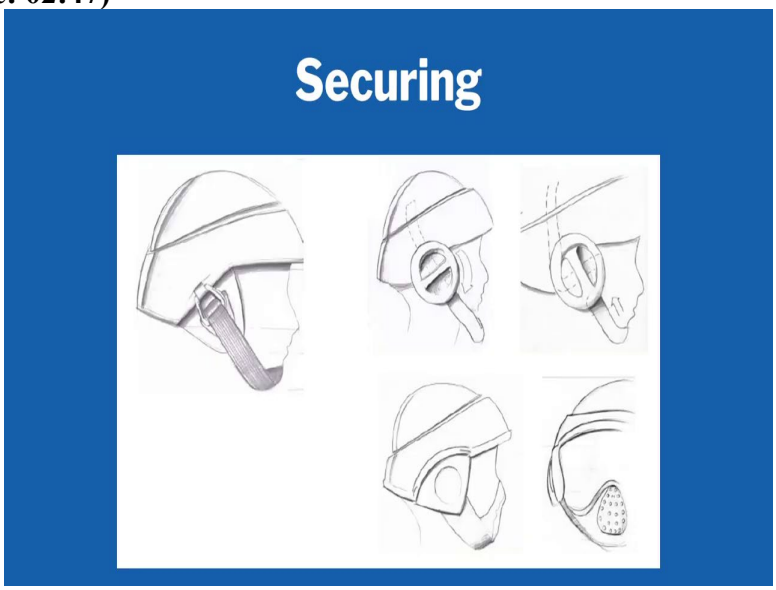

Made it two part receding. So that gap is also hidden and it only collapses when you need to store and you do not, you know, see the, you know, break very clearly and different sketches were made.

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And this is how the first conception came up about what the helmet should look like.

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(Student Professor Conversation Begins: 03:04)

Student 1: Sir, so does the break, like, structural integrity, like, in a collision?

Sir: Very good question! So just tell me, will the break compromise on the structural integrity of saving a person's head?

Student 2: Breaks (in the helmet) will like it will observe more shock.

Sir: It will absorb more shock because you are getting it closer to your head. This snug fit helmet is the best helmet for saving your life. And when the, when the hit happens it does not happen, something hitting you all around you head. Got it? Whichever side you hit, it gets closer and the fitting is also much better and you get much better, much better protection. And that is very counter intuitive. Right? So you have a much bigger task of convincing users.

That it's better than the other one and you should do, you should do evaluation by doing testing also.

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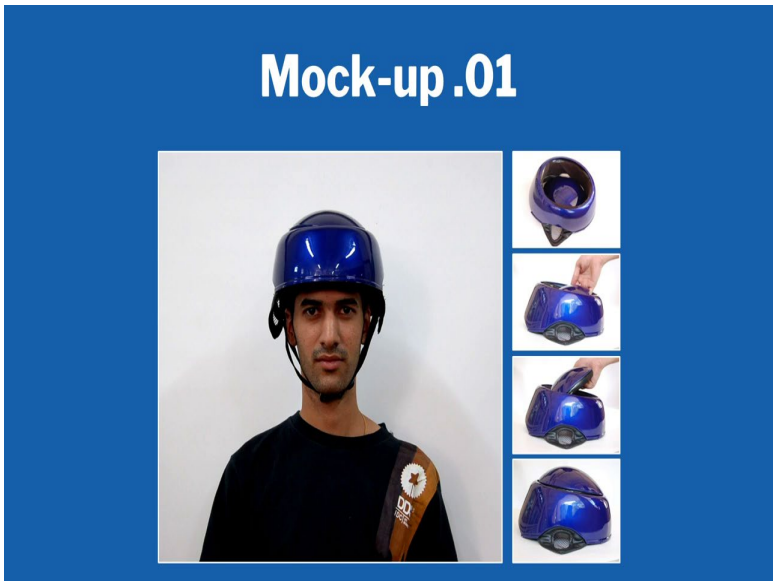

So here we have one of our *Mandar's* friend, wearing the helmet and showing, you know, how the helmet works and this is called the first working rig. Working rig will not be aesthetically pleasing. It will be built by using existing helmet parts.

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So he took a large, he took three large helmets, chopped them and created a helmet which will collapse. Right?

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He does not have the, yoo know, and then showed us how the thing works. He used the same buckle, he did not even use the elastic buckle. it is supposed to be elastic. Right? That is just a rig. It is not a mockup. When you use a mock up what will happen? It will not work but I can wear (it). It will not collapse, but I can show. I will show you a mock up also. This is a mock up. When it is full, this is the helmet when it is collapsed, this is the helmet.

It does not work and the volume becomes nearly reduced by two third, one third, sorry. So your mockups, this is a scaled mock up. You can have a full scale mockup which I have some in the lab. We actually have an Innovation Studio. When the student finished this project we wanted to carry this project forward, and we took it up with the Shenoy Innovation Studio and we started working on this by now experienced designers experienced engineers to take this forward.

When the student does their juries during their final presentation they have to show one photo realistic rendering.

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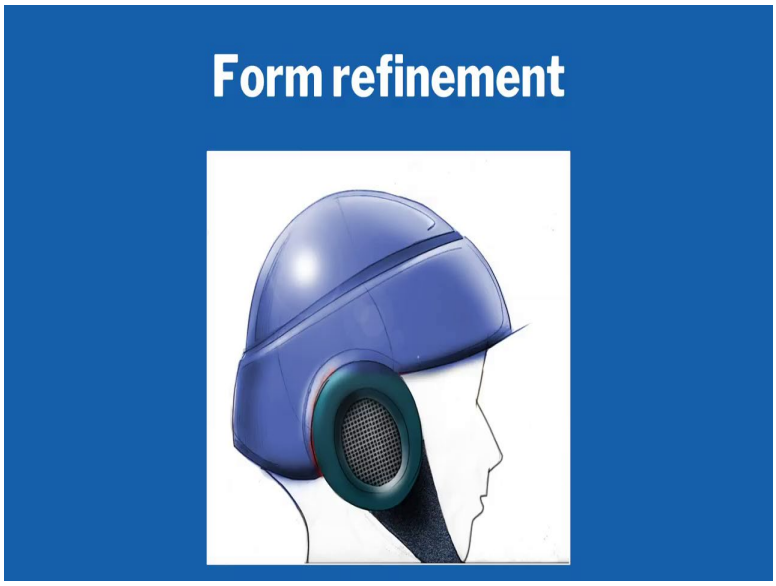

Which is the actual shape of the helmet, the form and style. Either show a working rig or a mockup model. Full scale mockup model. Please make a very good photo realistic mockup also which is as close to the mass manufactured product because nobody should be able to change your design intent later on. Now we are back to the Innovation Studio. So, Innovation Studio is a professional organization. Right? It is, it is not a student body anymore.

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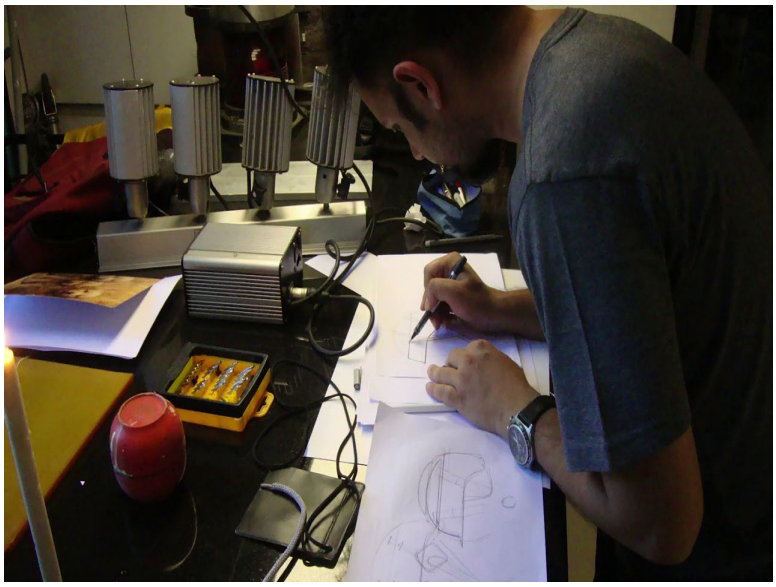

We got experienced designers with 4-5 years experience. We got engineers, we use a lot of consultants from outside to work with us whenever we have problems, you know, any of the materials and manufacturing and tooling.

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Remember I was telling you one helmet does not fit all, so we said whom are we working for, So we came up with a persona: an office going person that has a largest population of people who are using two wheelers.

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And they have, you know, the maximum problems and we chose that persona and this is that persona and then we found their daily routine, the average distances they travel, the type of vehicle they use, type of shoes they use, to get whole demographic information about this persona. So you are now clear about your segment of the user.

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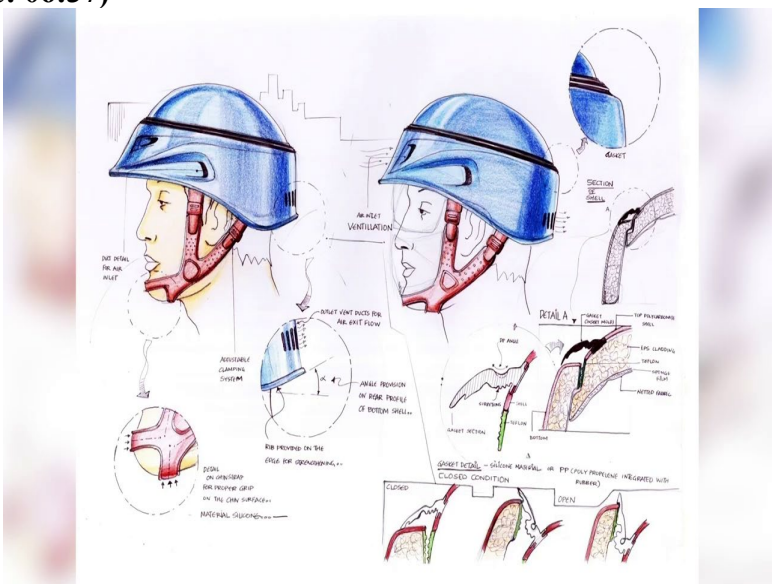

So with that segment of the user comes the very important task of showcasing the features of your helmet. So remember we were telling that the helmet will have a very good strap, which is elastic in nature with no buckling. It has a duck detailed so that the breeze will go in. Remember each concept has to have all the features, the breeze goes in and comes out and it keeps the head cool. This is an adjustable clamping system so that the elastic is not too hard on your chin. So, you adjust using the clamps which will take all the details of that.

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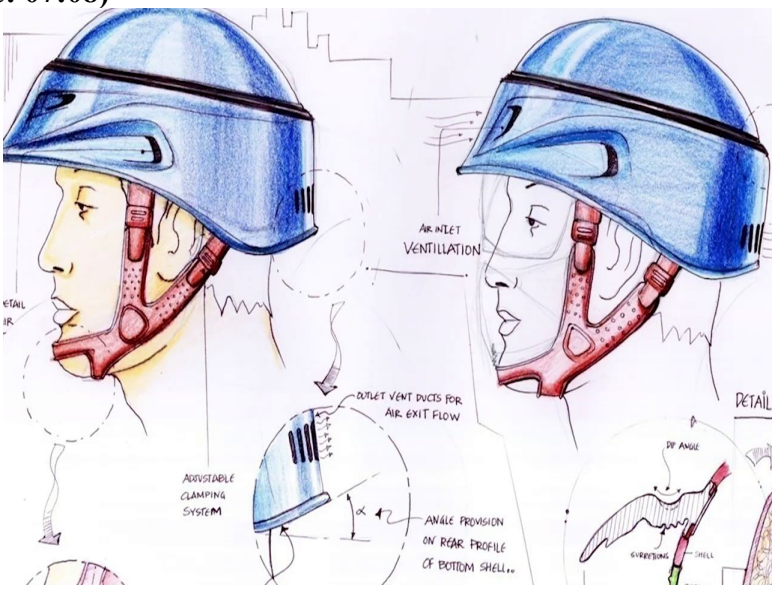

Then you have these vents which will take care of all the ventilation effectively. Then you also have this very interesting rubber.

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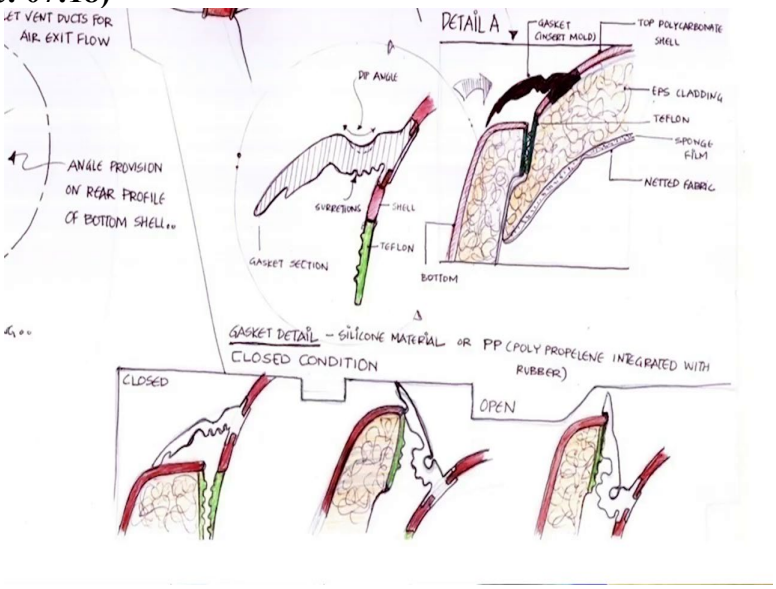

This rubber is very important, right? Because? If it is raining, the water should not go in, but it should also collapse and open up. So, the rubber detailing is very critical. So these are the initial sketches of the rubber detailing when the, you know, when the helmet goes in how will the rubber, sort of, becomes straight and helmet goes in and when I push it out how the rubber block the, you know, block the gap. So, this is a very large working, and we nearly spent 3 months working on this one detail.

It is that tough when you have any nice concept it is easy to say 'Ok it will go in and come out', but when you have a rubber detail over there, how will the rubber work? And the biggest challenge was the thermocol. Can I have a straight cut of thermocol? I cannot because that area will be weak. If there is an accident in that corner, the person will die. So we need to have an overlap and at the overlap the distance minimum 22 millimeter at all the length of the overlap. So once we did the overlap the helmet was becoming very large. So, multiple problems and these are all the features which we, you know, the helmet had to carry.

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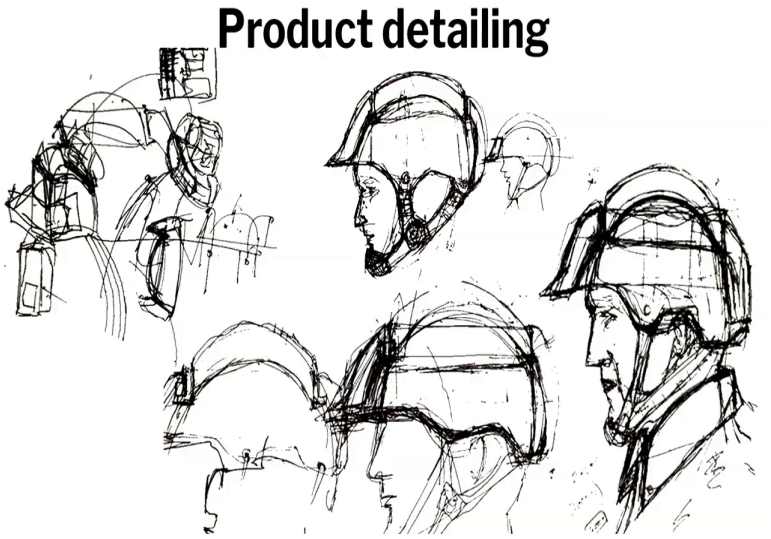

So then came all the product detailing aspects, how you detail out, how will you revit, how the shell will go in and out, the head dimensions, the control dimensions or how will the dimensions work. What are the other critical things? And these are generally, designer's doodles are very important for you to, you know, articulate, to come out of your thought process. So this is called externalizing your thought process.

When you sketch, for example when you sketch, you know, he is looking down, but when you sketch you externalize your thought process and then when you resketch again you see the number of lines, when you resketch again what happens, your internalizing and externalizing again.

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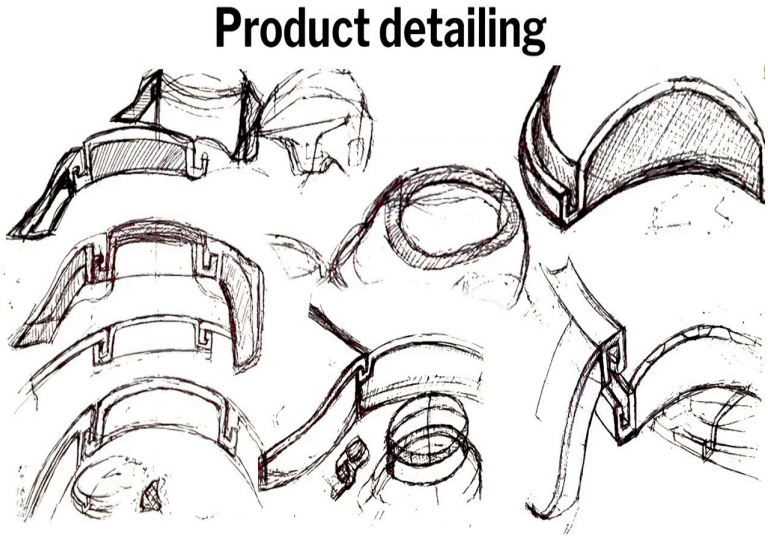

So the doodles are a very important creative journey in any design journey. So, then we did all the detailing of how the thermocol shell works, what type of shape, what type of plastic, you know, covering should come on it and how will the plastic break and lock into each other. Remember this plastic shell has to lock into this plastic shell. Right? So how will that locking happen? Will it be very wobbling or lose. Remember, one of you were saying it can be more dangerous if it is not good enough, that will go and pierce your head.

If your helmet is not, if I have too many ribs that can go and hurt the user. You're not, as per IS standards you can't have any, you know, projections inside.

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So, you have to be careful in all your detailing of how your detailing will be done, all these, you know, sketches are all about detailing and taking the markup model, remember, we had the designing solution, to the next level of product development.

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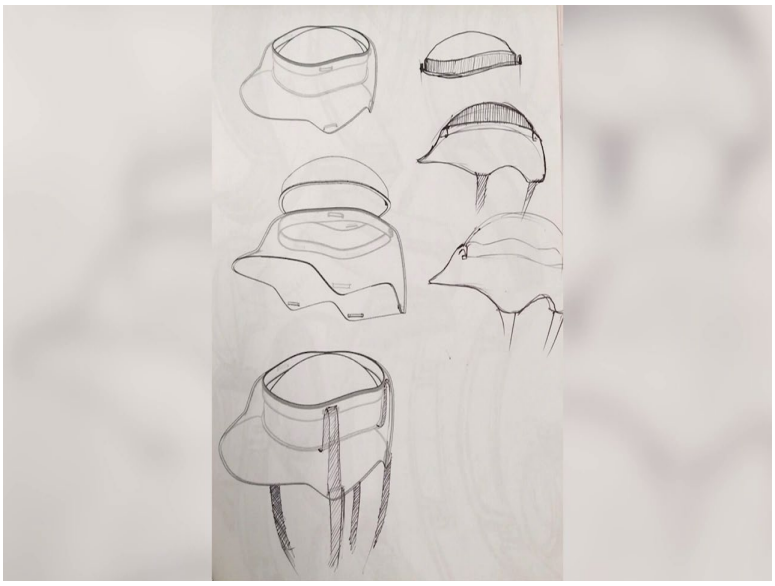

And then the biggest challenge was, you know, how will your top be buckled to your bottom? See you have the top shell and that has to be buckled to the bottom shell. This aspect was, you know, thought of multiple times. Should this shall be connected to this and then this should be connected to the chin? That was one option. The second option is the top one should be connected to the strap and this should be connected to the top. You got it?

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Because the top should be tightest so this is connected to my chin, and this fellow is just hanging over there with the top. That is one option.

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So you have multiple options of thoughts is that, this is a very very big challenge of strapping.

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How will you strap the helmet was also very, very challenging task. This also took a lot of time. Nearly how many years, took nearly 2 years to come up with, to sort out all this.

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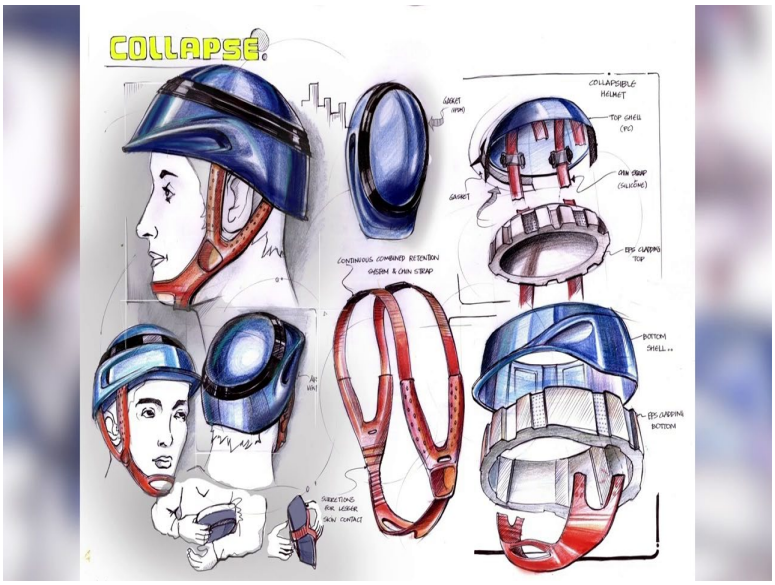

And then came the final design details.

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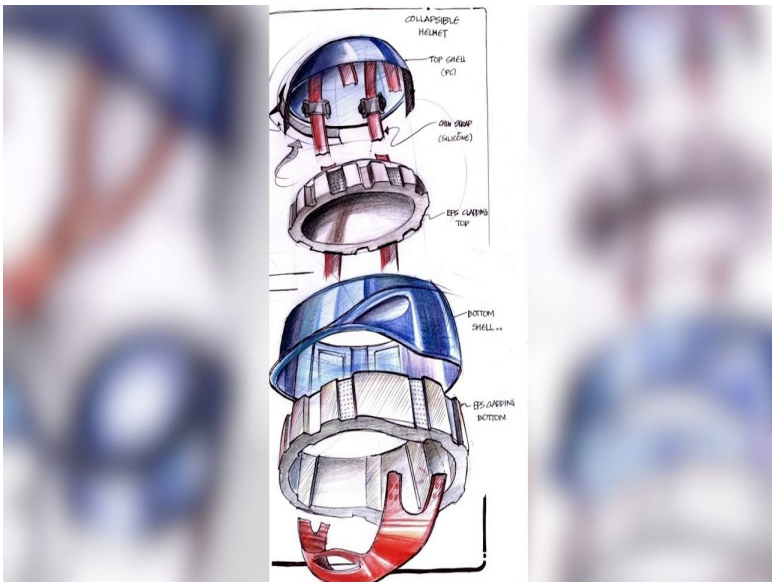

You can see how the thermocol has slots of this strapping. So, finally what we decided, we are strapping from the top, right? We are strapping from the top through that thermocol that is coming. Then it is strapping from the bottom, the bottom is hanging there and hence , you know, buckle is there. So this is one stage, there are multiple stages of development. This is one stage of development. And after this stage of development, like a, you know, Mr. *Chari* was our own aluminou with a lot of experience in the industry, you know, again, you know, went out and joined another company and then, we had another designer join this called *Ashish*.

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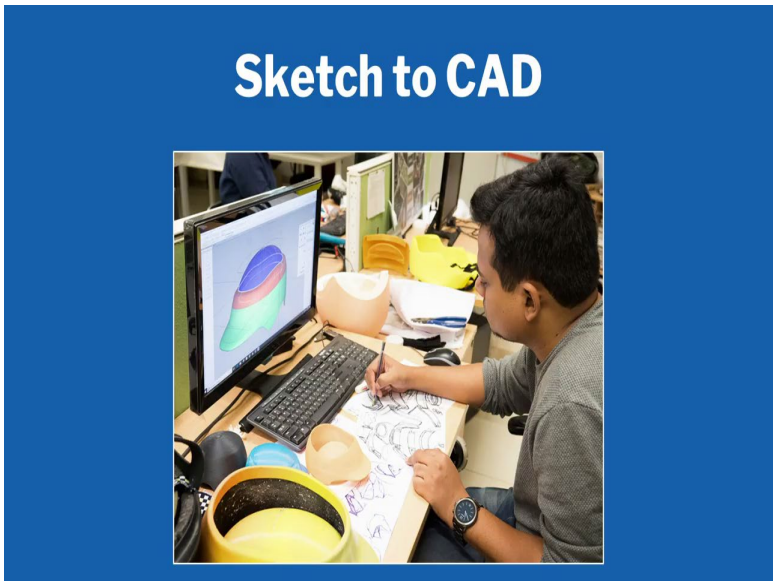

Ashish is now, you know, a M.Des from Indian Institute of Science (IISc), was sitting continuously with this product for another one and a half years. So, remember I was telling you, every idea which is creative and which is good for the user can be detailed out to become a good concept. So, that was a very strong belief in me, I said I am not going to leave this. If collapsing is going to solve my problem for both ventilation and ease of storage and ease of wearing, I am going to leave no stone unturned to see to it that this is implemented from multiple levels, the materials used, the technology used in the manufacturing technology.

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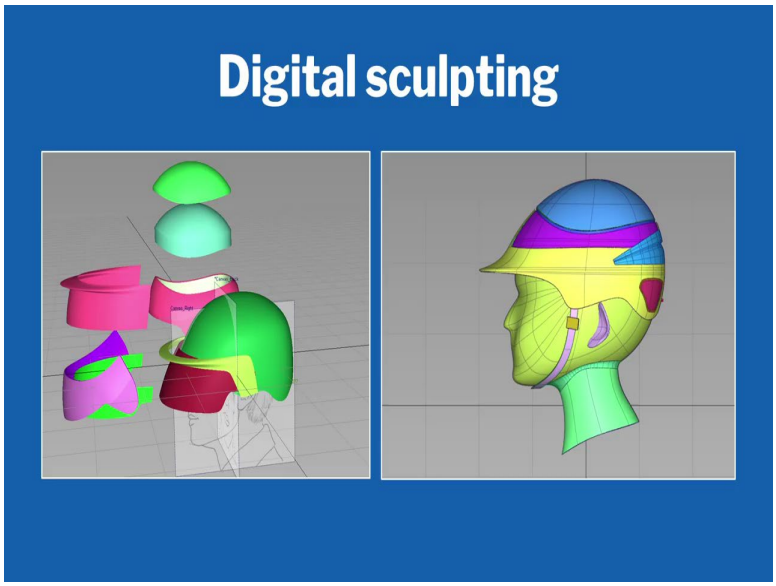

We will do everything to take it forward. So we then did the digital sculpting to get all the shapes in. Now the very important aspects started happening. Remember when you see this helmet more

on head, you will not see the break because it is on the top right, so we had to take this cut inside, it is longer out, remember the earlier helmet the cut was outside which you can see, so user perception was also a very very important aspect for us. We took that and then we, you know, got all the detailing done, we went back and did the strapping to the bottom section.

So it is strapping to this one and attached this to this one, that was a much better idea, because when you pull this will automatically sits.

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And finally, you know, this is one of the stylized versions which we couldn't fabricate because the thermocol was not fitting in this also had to be rejected.

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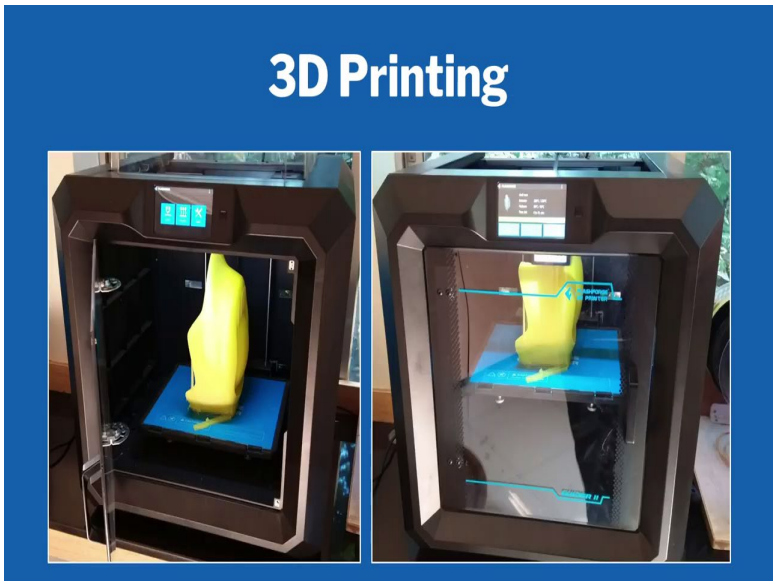

And then, you know, we build the final option where with the steps coming in and with that step we used 3D printing machine very creative, to vertically, to make both the shells of the product.

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And with this we came up with the option of the rib and the support structure and how, you know, for example, the volume of travel which will happen inside and you also check the thermocol how it will go in.

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So this is the final redesign option with the visor of the total design which had all the components of the collapsing, the ventilation and the visor is a very important component in every way.

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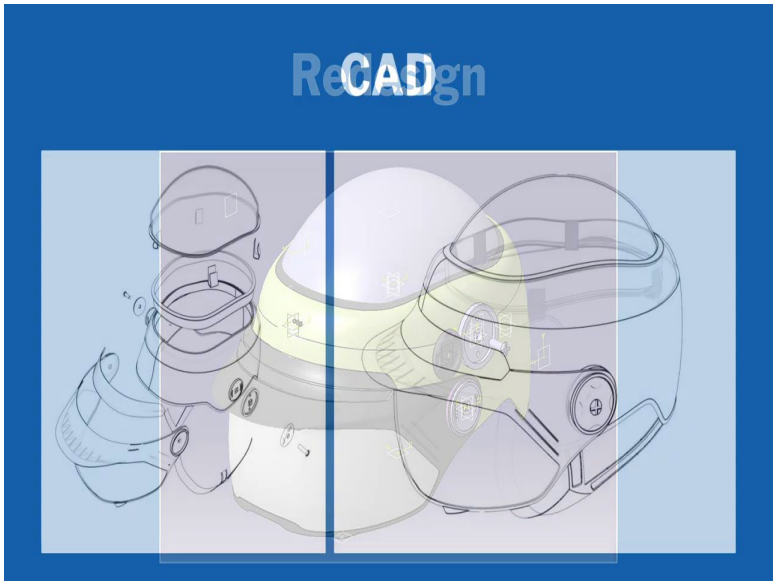

And this is the final detailing of how your whole product was made with all the clamp, buckles, rivets to put all the, all the parts together.

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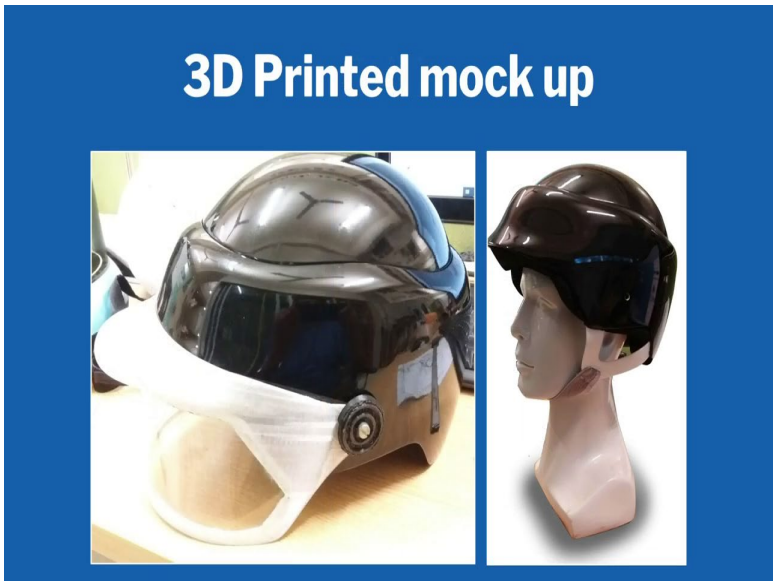

And from the CAD model we did, we did multiple 3D prints, you know, they would be an error over here so we would print again join that. So, in this case is the bottom shell and then we also have the gasket 3D printed. Unfortunately the 3D printed gasket was not very, you know, was not very good. It became very tight when we assembled it. Some other components are very difficult to 3D print because the hard components are very easy. The flexible components are generally it is good to mould them.

They are available in the market and we mold them because the molding costs is not very high. For example, the tool cost for this part could be as high as 8 lakhs. Whereas the gasket tool would be just about 2000 bucks. So it is good to, you know, do the gasket in real and do this in 3D print for your trial purposes and after that, you know, can, you know, take things to go forward.

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And then, you know, we came up with the final version of how the collapsed state, what type of volume it will occupy and you will also see that it forms like a little small rectangular space so it is easy to put in a bag. So it can go into a bag which is like a slot or we can put on a rack, so multiple, you know, advantages come in. And we also want to have ventilation on the top so if you lift the gasket ventilation ports are available for air breathing in.

So these are the, you know, designs which came up as the final design. I think, as of now in this design, we kept the visor fixed and it can be, you know, it can be actually swivelled up. But actually, you know, if you remove the skewes it is removable. So if somebody wants to buy a helmet without a visor they can buy it. So it's that kind of option that is currently available. But we thought when we did the survey, with the mock up models, everybody said that they needed it with the visor.

Student: Also, did you consider space for spectacles?
Sir: Yes, so that was a very important component. So here you can see the type of visor just coming out so much. So if you see the model, enough room is there, the visor comes out like that.
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So this is the, you know, first prototype we made and we tested by wearing. Look at the distance, pretty large the visor. So then what happened, then we integrated the little cap type design with the visor. So this is the visor, you know, where, you know, the cap was integrated. It is still under progress. Making the transparent 3D printed parts are very difficult, so we are not able to get in a single component. So we actually did this 3D printing and kept using a transparent gasket over here but it still does not exactly mimic what you want. So we plan to mould this, you know, finally to get the visor right.

Our another idea was can I just snap on the visor and whenever I want I snap it on and I take it out. So, this also has this elastic for wearability so it is easy to wear. But it has a special purpose to, you know, in the way you have to be trained to wear it.
So this is very critical. So we were just wondering how, because if you wear it with and elastic it has to be coming from the front, you know. So we were trying to see how we can, you know, integrate that as a convenience of wear and, you know, opening also has to happen like this.

So we were trying to block it and, you know, see to it that it is always blocked over here, so when you are wearing you have to put your fingers in and wear. So, it always lock like this, you know, locked like this. So that we are still working out. So that this one, you know, collapses inside and becomes like this much. If the visor should have been there, the visor is there, the visor would

open up a little bit and it also, because the visor is from here to here and now this has been, gone into the visor and it will open up and become this close.

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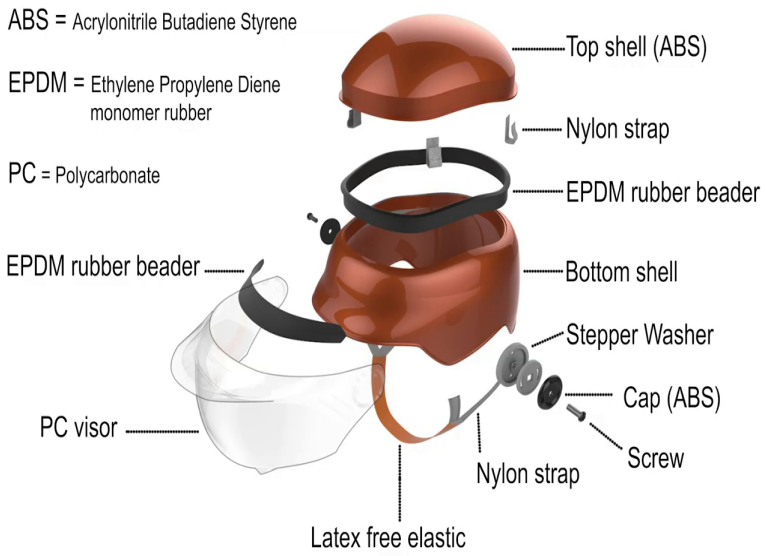

The gasket is made of either EPDM or we can use Polyurethane and this is also injection molded. You can use engineering plastics which is like polycarbonate, APS for motorcycle racing, but if you are doing a regular to, you know, regular work, which is here, it can be, you know, in a simple blend of ABS, which is much stronger. So these are all two, injection molded parts. The thermocol shells are made of expanded polystyrene you have.

So here my challenge is, you remember, the earlier helmet had only 2 dyes. Here I have four. Two plastic dyes, two thermocol dyes, one visor dye and then the elastic strap. Infact I must give you a good example over here. Did I tell you the example of the VIP Luggage Company, the VIP luggage company, there is my senior from IDC, who is the head of the, he is the vice president now, and he is based in Hong Kong to source all the components, because if you are not, if you are in the world market in luggage, you must have the components of ecosystem at level which is common in the world.

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The zippers, the plastic trims, the luggage or the polycarbonate shells, it has to be at that level. That is a very important understanding for us that to innovate, you also have an ecosystem around you which will work very effectively to take this forward.