STAR WARS

ENDOR TROOPER DONUT

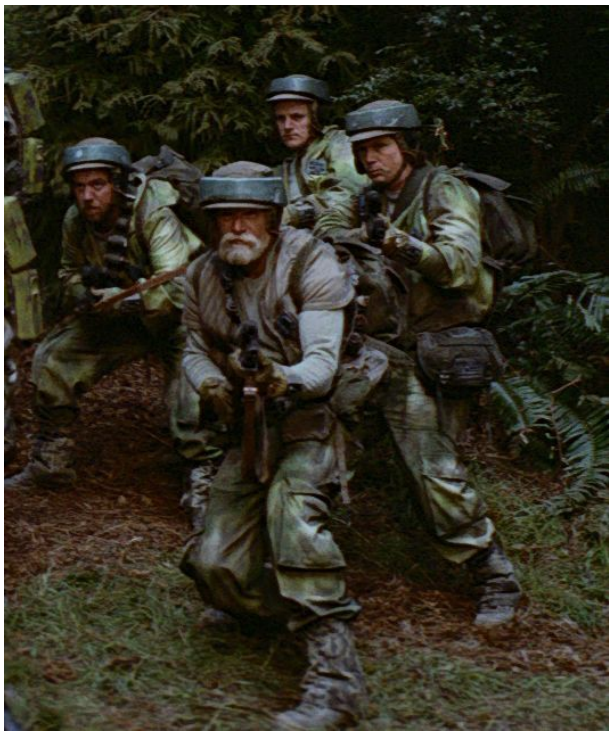


Image from Star Wars Episode VI: Return of the Jedi © Lucasfilm Ltd

The Alliance commandos who assault the shield generator on the forest moon of Endor wear a helmet that consists of a modified ANH-15 flying helmet surrounded by a rigid donut. The purpose of this document is to provide instructions on how to construct a replica of this donut. The modifications required to the ANH-15 flying helmet are beyond the scope of these instructions.

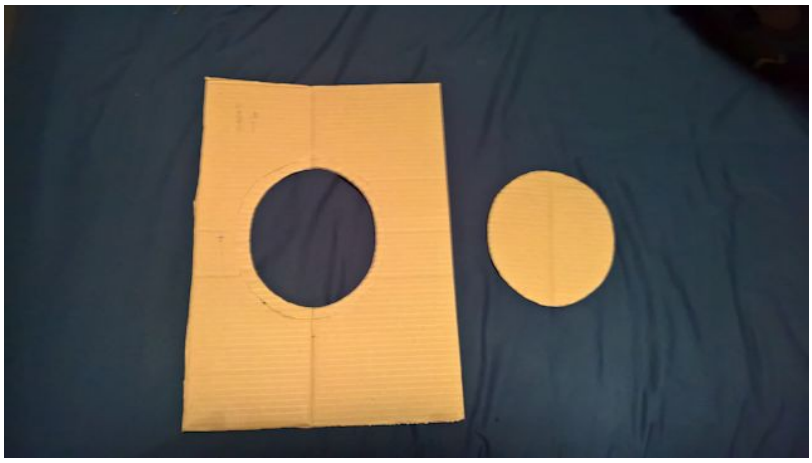
Materials.

3 x 325x220mm sheets of 2mm thick plasticard.
1 x 440x325mm sheet of 2mm thick plasticard.
1 x 325x220mm sheet of 1mm thick plasticard.
1 x 440x325mm sheet of 0.5mm thick plasticard.

Cardboard and paper for making templates.

Constructing the Initial Template.

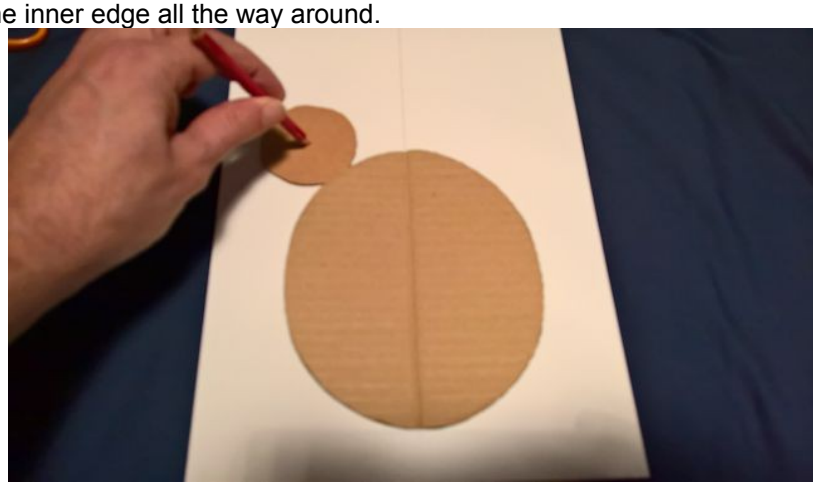
The donut is worn around a modified ANH-15 flying helmet so to construct the initial template that will be used to construct the top of the donut you should be wearing this.
The top of the donut is located approximately 50mm above the hem at the bottom of the flying helmet at the front, just above your eyes. At this level you should wrap a length of wire (or a flexible curve spline if you have one) from the front to the back of your head. This will give you one half of the template you need to make from card. Use this to draw a curve and then mirror it before cutting it out. You can test that this is the right size and shape by placing the waste card around your head. It should sit at the 50mm mark above the front.



The initial template (right) and the card sheet it was cut out of (left).

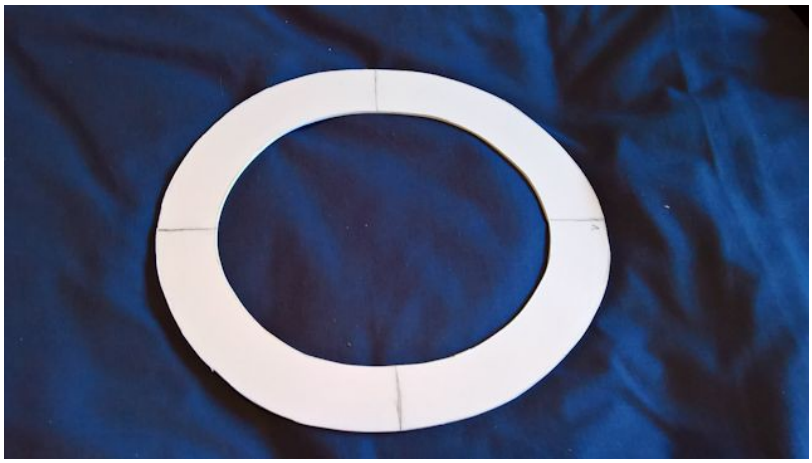
Making the Upper Surface.

The card template is taped to one of the 325x220m sheets of 2mm thick plasticard, leaving a gap of more than 30mm all around it.
Draw round the template to construct the inner edge.
The outer edge is drawn by offsetting this outwards by 30mm. To do this take a circle of cardboard that has a radius of 30mm. Poke a hole in the middle of this just big enough to take the tip of a pencil. Now rest the edge of the circle against the template that should still be stuck to the plasticard and use the pencil to drag it around the outside, keeping the card circle touching the template at all times. This creates a line that is 30mm away from the inner edge all the way around.



Drawing the outer edge using a 30mm card circle to offset the line from the inner edge.

The card template is now removed from the plasticard and the top piece is cut out. Marking centre lines on this will come in useful later on.



The top piece with centre lines marked on.

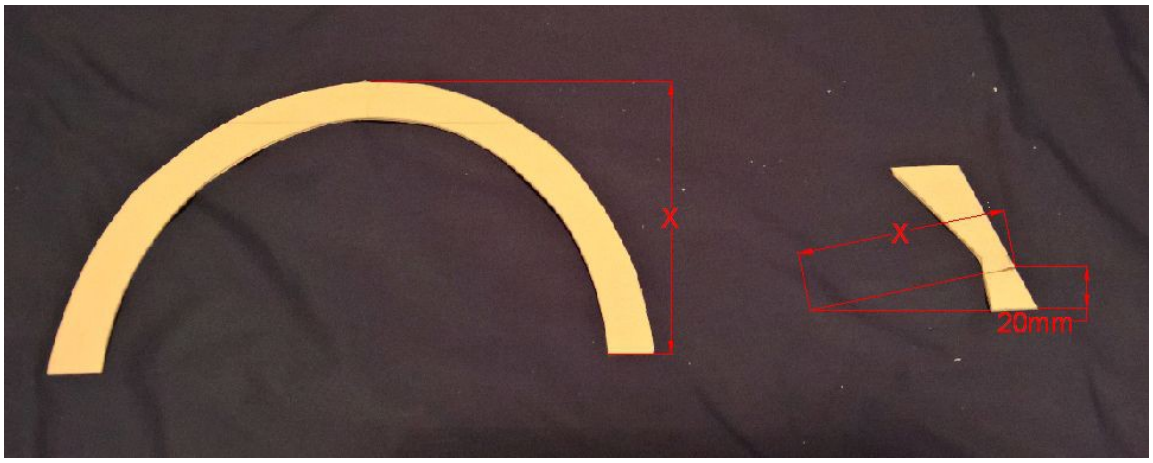
Making the Lower Surface.

The lower surface of the donut is made from two parts. One at the front and another at the back of the donut, meeting below the centre line of the upper piece.
Each of these pieces is constructed by taping the upper piece to another 325x220mm sheet of 2mm thick plasticard so that the left to right centre line runs along the edge of the sheet. Draw around the upper piece to create the inner edge and then produce the outer edge by offsetting this by 20mm in the same way as the upper piece was marked out.
Repeat this for the other half and then cut them out. Again, marking the centre line will be useful.

The two lower pieces.

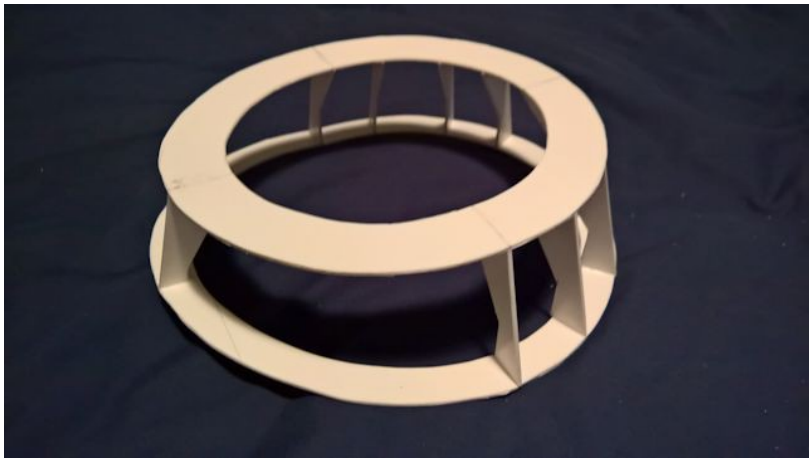
Assembling the Frame.

The frame requires ten supporting struts between the upper and lower pieces. Dimensioned templates for these can be found at the end of this document.
Ten main frame supports need to be cut from 2mm thick plasticard, nine of which are used to connect the rear lower piece to the upper piece. Glue one support at the rear centre line of the upper piece and one each at the left and right centre lines of this piece. The 30mm edge of the struts are glued to the top piece so that they run the whole distance from the inner to outer edges. Then glue six more supports between these (three between the rear support and each of the left and right supports) so that they are spaced out evenly around the back.
The tenth support needs to be modified before being stuck at the front centreline of the upper piece.
First measure the height of the front lower piece as shown by the letter 'X' in the image below. Then mark the support on the outer (long) diagonal edge 20mm above the base. This is where the support will be cut from.
To obtain the angle of the cut project a line from the base of the full strut and measure to the point on this line where it is 'X'mm from the mark just made. A line between these two points is marked on the strut an it is cut along this.



Determining where to cut the front supporting strut.

With the front supporting strut cut it is now glued to the top piece at the front centre line.
The two lower pieces are now glued in place, starting with the back. Glue the lower back piece to the bottom of the struts so that the centre strut meets its centre line and the two struts on the left and right centre lines of the upper piece meet the ends of the lower piece. Each strut should stretch from the inner to outer edges of the back lower piece.
The front lower piece is then glued in place. The centre lice of this is glued to the forward supporting strut so that the very front of the strut meets the outer edge of the front lower piece. The ends of the front lower piece are glued to the ends of the back lower piece to complete the frame.



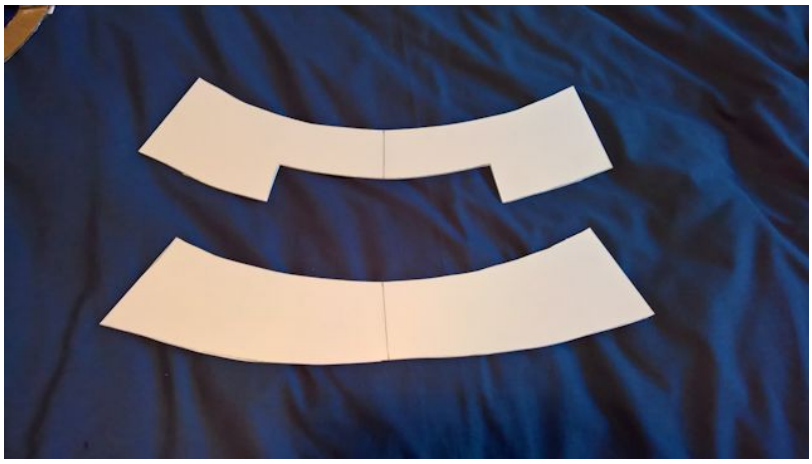
The finished frame

Adding Front and Back Plates.

The creation of the front and back panels used to cover the sides of the frame are made from 2mm thick plasticard. Before going to plasticard however, paper and card templates are constructed. First of all wrap paper around the frame and cut it to fit. This will provide the approximate shape of the panels. These meet at the point where the frame tapers towards the front.
The thickness of the plasticard that will be used for the final parts means that their shape ill not exactly match the paper template. Therefore, the paper templates are instead used to create a second set of templates from cardboard of the same thickness as the plasticard. Taping these around the frame allows them to be modified to match it more closely.
The rear plate requires an indentation into which a detail plate will be added later. This is centred on the rear centreline of the donut and stretches both ways halfway from the centre line to the ends of the template. The curve of its upper edge is 5mm below a centreline drawn along the curve of the template.
Once the card templates are correct they are taped to the 440x325mm sheet of 2mm thick plasticard.

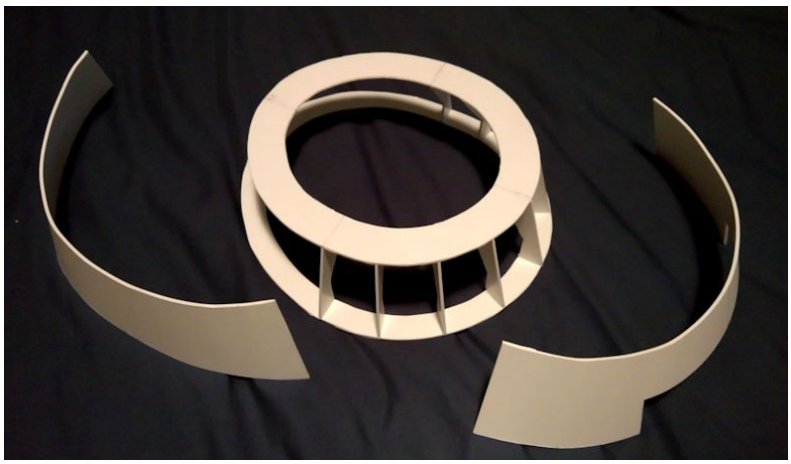
Card templates laid on plasticard

After drawing round the templates they are cut out.



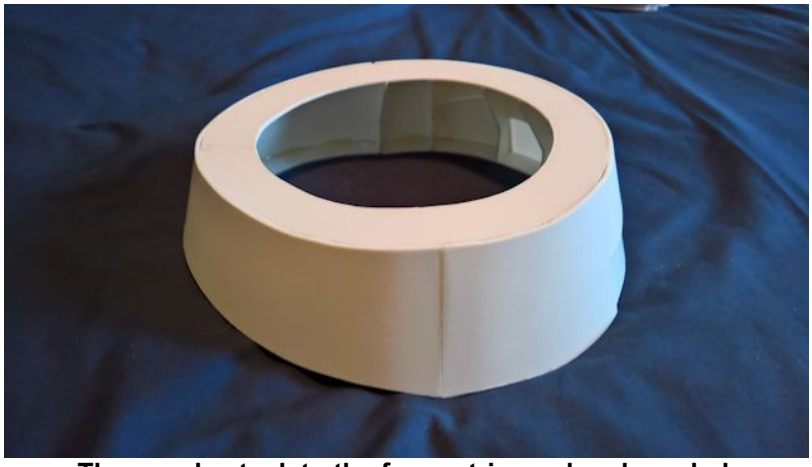
Front and back panels

Before the front and back panels can be stuck to the frame they must be bent into shape. The plasticard is flexible, but needs to be heated to allow it to bend far enough to be made to fit the frame. This is done using a hair dryer. Heat the front and back plates and then bend them into roughly the right shape. They will spring back somewhat but they can be bent far enough that you can finish the job by hand when gluing.



The front and back panels bent into shape

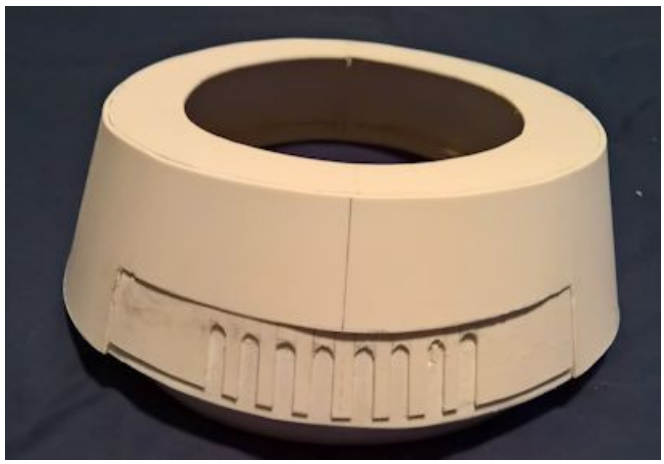
The back of the frame where the indentation in the back panel will be located needs to be covered with 0.5mm thick plasticard before the back panel is glued in place. This is best achieved by sticking an oversized piece of 0.5mm thick plasticard over the back of the frame and trimming it to match the bottom. The back plate can then be glued over the top of this and the front plate glued to the front of the frame. Leaving the glue to dry fully before moving on. Securing the front and back plates in place with tape is a good idea. Once the glue has fully dried any excess parts of the front and back plates can be trimmed off and the edges sanded to get them to match the frame as closely as possible.



The panels stuck to the frame, trimmed and sanded.

Adding Rear Detail Plate.

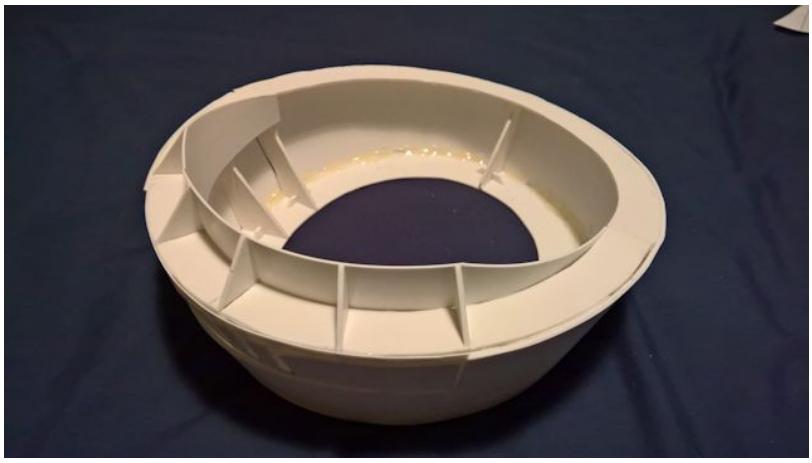
Use paper pushed into the recess running around the back of the donut to create a template of its size and shape. Then remove the bottom 5mm so that the detail plate will not meet the bottom of the donut. Then copy this to 1mm thick plasticard and mark the vertical centre line.
Eight groves are required to be cut into the detail plate. These are equally spaced about the centre line, each 6mm wide and there is a gap of 6mm between adjacent groves. The tops of the groves are rounded and the top point is 5mm below the top of the plate.
Once cut, this plate can be bent into shape without the need for heating and then glued into place.



The detail plate glued into the rear recess.

Adding Lower Section.

To construct the lower section of the donut first cut a long strip of paper to act as a template for the inside of the lower section. This needs to be 45mm wide and long enough to reach all the way around the inside edge of the back lower plate. This inside piece will be glued to the frame so that it protrudes 25mm beneath it, mark a line along the length at this height.
Next fold the paper template into four lengthways. The outer creases of these folds are then used to create the taper of the lower section, drawing lines from where these meet the exposed edge of the plate to the end of the line marking out the area that will protrude below the frame and then cutting along them.
With these lines cut the template can be copied to 1mm thick plasticard and glued to the inside of the frame. It will need bending first but this can be achieved without the need for heating.
Five lower section supports are now added (dimensioned templates for these can be found at the end of this document). Each of these will be glued so that the diagonal edge runs from the exposed edge of the inside lower plate to the outer edge of the back lower piece. One is glued at the centre line, two from where the inside lower piece begins to taper at left and right the last two between these so that they are even spaced around the back of the donut.



Inside lower plate with supports glued in place.

Once these are all glued in position the lower section needs to be covered with 0.5mm thick plasticard. The process for this is similar to making the front and back plates except that it uses thinner plasticard and so needs only a paper template.
First cover the area around the lower section in paper that extends as far as the join between the two lower pieces of the frame on each side. The paper will have to twist somewhat as it goes around the donut. This is trimmed to the right size and shape to cover the lower section, meeting the exposed edge of the inside lower piece at one side and the outer edge of the back lower piece of the frame at the other.
Once cut to the correct size and shape this template is copied to 0.5mm thick plasticard that is glued into place and trimmed as needed.

The lower section covered.

Final Stages.

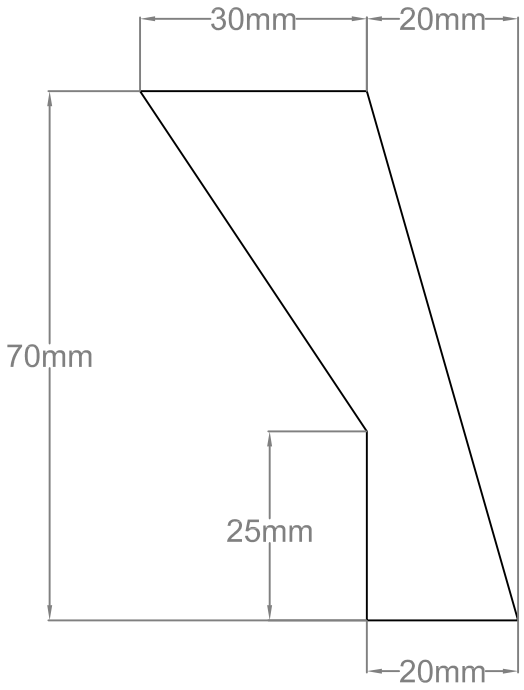
With the lower section added all of the gaps can now be filled with milliput or some similar compound, after which the donut is ready to be painted.

The completed donut worn over an unmodified ANH-15 flying helmet.

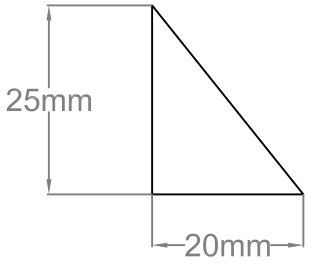
Video Tutorial.

The process of making this donut was recorded at each stage. The video can be seen on my YouTube channel at:
https://www.youtube.com/watch?v=-h2Uhai8H-4

Main frame supports (x10)



Lower section supports (x5)



All pieces to be made from 2mm thick plasticard

Making an Endor trooper donut
http://thehazugfiles.uk/Index.htm