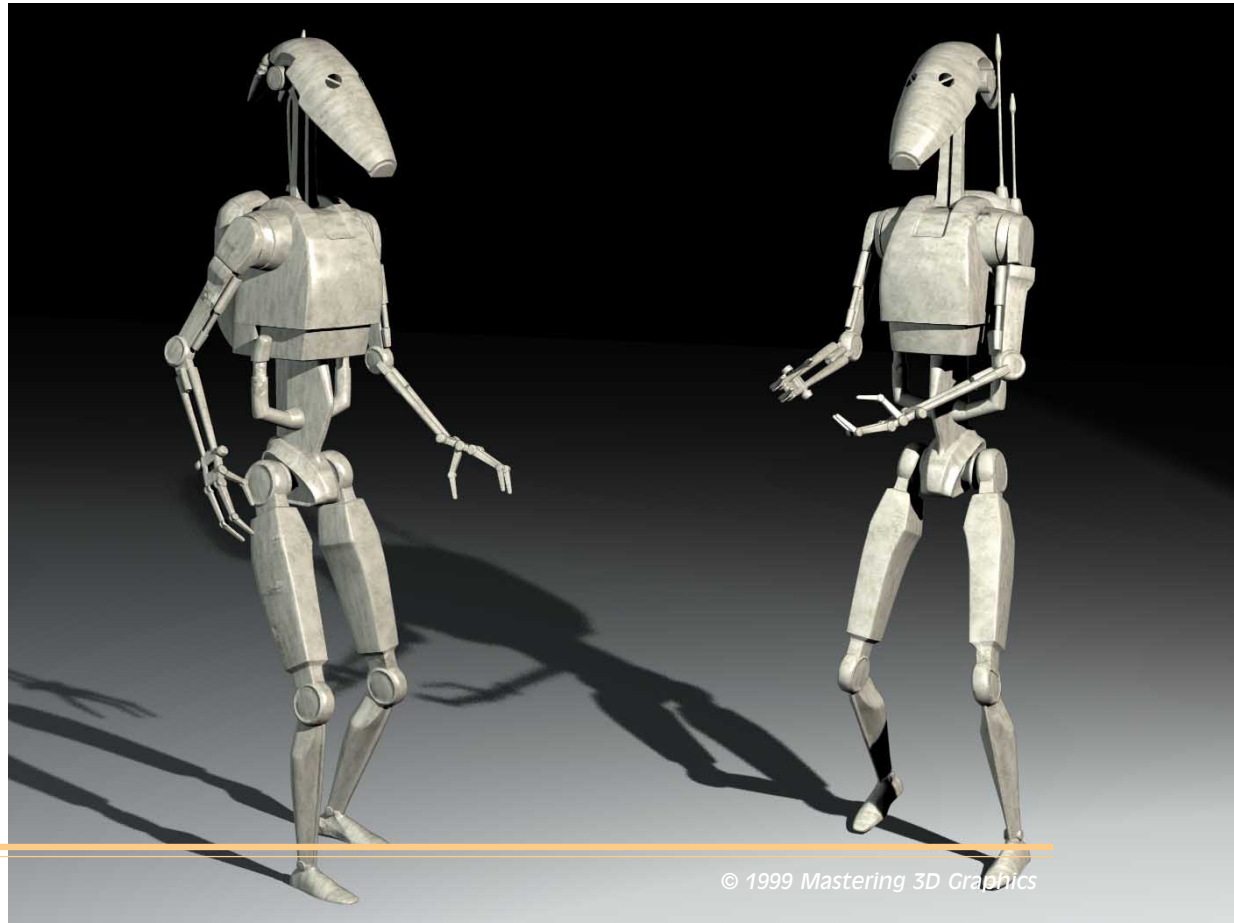


Animation:Master ~ Mike Hough

Many nations and worlds have no choice but to resort to using military hardware to defend themselves in the unstable political climate that exists in Star Wars: The Phantom Menace. Battle `droids have replaced their human counterparts as the soldiers of choice in the galaxy. They are loyal, fearless and above all, easily replaced. It's hard to beat an army that never retreats.



Considerations

There's nothing particularly difficult about this model. A robot or `droid is more abstract than a humanoid character, so placement and detailing of specific features is less important. One nice thing about a `droid is that it isn't one complete surface like many other character designs. The different parts can be assembled just like a real machine. Therefore you don't need to worry about how the arms joins the body or the head joins the neck – build each part one at a time and assemble them. You only need to make one arm and one leg without worrying about how they will connect to the body when you duplicate them – they will automatically fit if they are designed correctly at the outset.

In keeping with this “assembly line” approach, you should separate parts into logical groups as you build them. Things could get pretty wordy if I were to mention each time you should do this, so I'll leave it to you to decide when to create a new group. In the case of this particular model it is a good idea to use different surfaces (connected versus disconnected) to define these groups.

Tools

Animation:Master is neither the worst nor the best package for this job, in my opinion. It isn't really designed for precision modeling, yet the splines themselves are well

suited to mechanical design. Although some other programs have more tools for doing precision work, I find A:M easy to work with.

Whilst the article is focused on creating this character in A:M, I think you will find the overall methodology applicable to the majority of 3D programs. This is particularly true if you use a program that supports NURBS (Rhino comes to mind), since Animation:Master's patches are similar in many ways. However, polygon modelers should be able to perform all the tasks outlined in this article as well.

We will deal primarily with closed splines that are extruded to create surfaces. I'll often refer to these closed splines as cross-sections. Most other applications allow you to loft curves, and that's a method I recommend if it's available to you. Some even let you fillet edges, which is good for smoothing hard edges. Animation:Master doesn't have many of the more advanced tools but the splines are so easy to work with you probably won't miss them.

Modeling the head

Draw a cross-section spline that looks sort of like a squashed half circle. Extrude it to create a cylindrical shape

that is narrower at the ends and has a little bulge about two-thirds of the way back (figure 1). Keep the bottom of the shape flat by moving the section up slightly. The bulge should be less noticeable from a top view than the side, so you will need to scale each section unevenly on the Z and X axes. About halfway back on the head the lower section tapers up. Select the lower points here and drag them upward slightly (figure 2).

The back of the head is rounded and tapers inward strongly along the bottom. Extrude a section back only slightly and then scale the points near the bottom inward. Con-

tinue extruding about four times and rotate each new section to round the back of the head (figure 3). The inden-

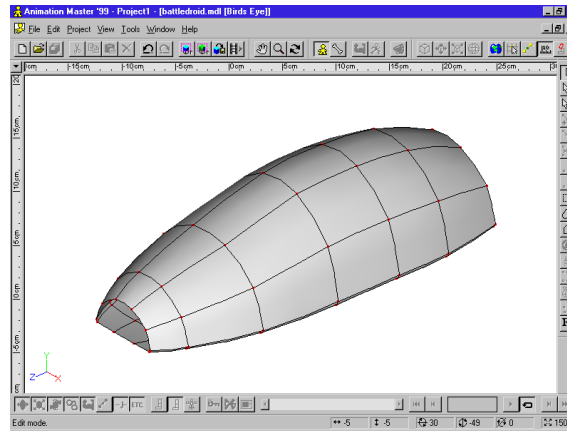


Figure 1: The foundation for the head.

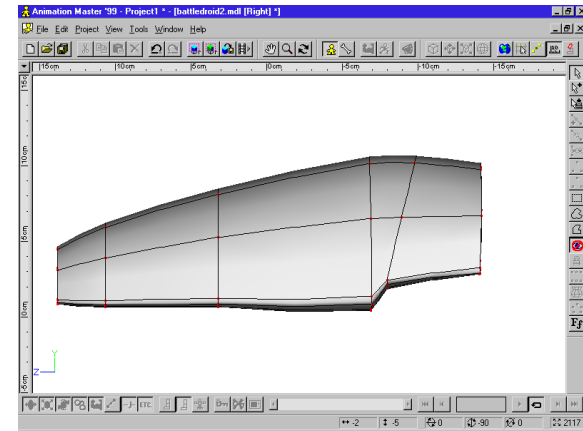


Figure 2: Drag some points up to create an indentation on the bottom.

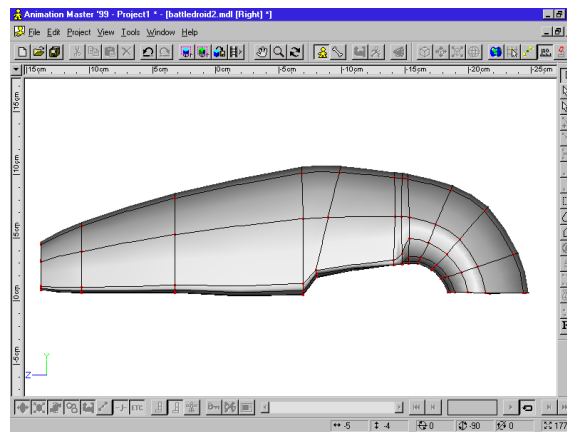


Figure 3: Extrude back further and rotate new sections.

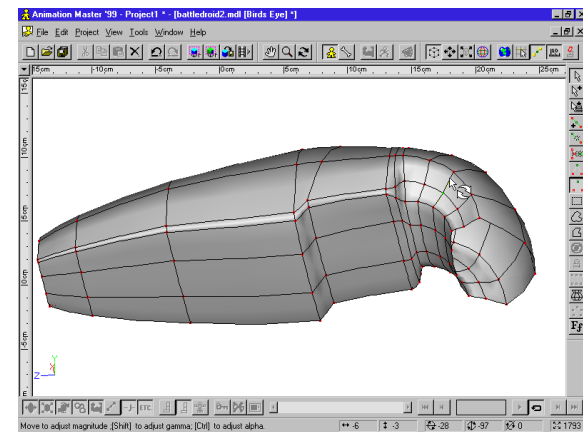


Figure 4: Adjust bias on the sides to emphasize the concave area of head.

tion on the side will be a little rounder around the edges than we want, so turn on “show bias handles” and adjust the bias along the bottom and top edges to sharpen them a bit. Increase the bias of the points in the center of this area to make the effect more pronounced (figure 4).

We want to close off the front of the head next. Extrude the front section once, scale it a very small amount and move it forward an equally small amount. The next extrusion should create a flat surface that is scaled inside the last one. Now you should be able to close off the front by drawing splines connecting the top and bottom. You don’t need to worry about creating 3-point patches or how the splines flow together because this area is flat.

Next we’ll make the front piece. This little shape on the front adds the impression of a mouth. You can just make a copy of the front cross-section as your starting spline and extrude the outer edge to make the new shape. Scale the new shape so that, from a front view, it fits inside

the front of the head. Then select the points along the bottom edge and drag them down (figure 5).

Where the neck attaches to the head there are two large bolt-like objects. Create a closed spline of 4-points and adjust the bias on them to make the spline round (use a magnitude of 167.4 to get the roundest shape). Extrude it as in figure 6 and close off the opening with a spline. Make a copy and flip it to go on the other side of the head.

They look like ears to me...

On each side of the back part of the head are two little shapes that hang down like ears. At first glance they look like they would be very difficult to create, but a little pre-planning makes this part a snap. You want a cross-section

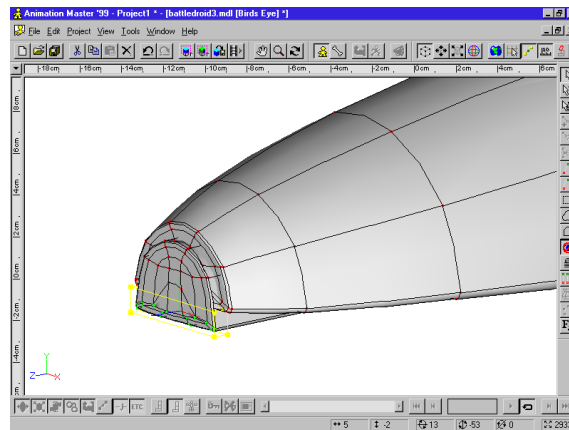


Figure 5: The mouthpiece.

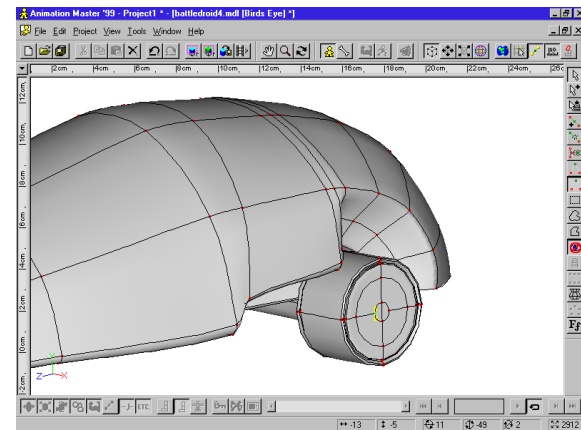


Figure 6: A “bolt” on the side of the head.

tion that, if extruded, would have enough points to create the 3 indentions near the top.

Notice in [figure 7](#) that the cross-sections are bunched up in this area. Select the point inside each indentation and scale them smaller, and then scale them on the Y-axis only so that they make a tight fit around the outside edge. You'll need to move them so they line up with the center ([figure 8](#)).

Create eyes

I don't normally use boolean cutters because they are time-consuming to setup. They are however, a good option for the eyes considering the time it would take to

work the eyes into the head using patches, not to mention the loss of smoothness that could result.

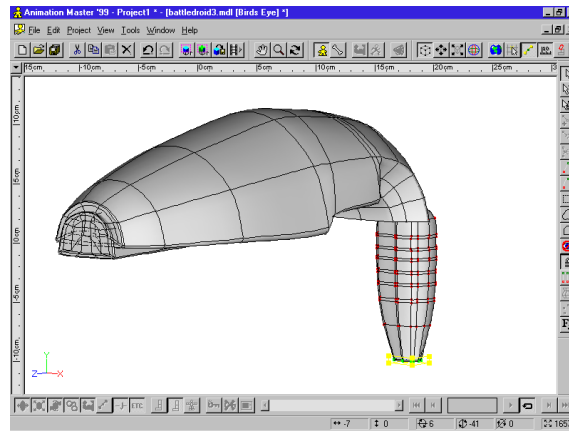


Figure 7: Rough, extruded shape of the ear.

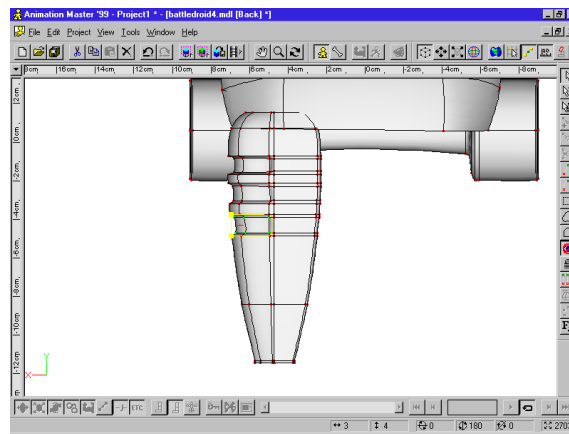


Figure 8: Scale groups of points inward to make indentions in the ear.

Draw a half-circle shape, create a copy of it, and flip the copy so it mirrors the original, thus forming what looks like a circle with a gap across it. I changed the bias gamma of the two corner points to 90 and adjusted the magnitude of all the points to create the shape in the figure. Also, you need the shape to be closed for the boolean operation to work and watch out for internal patches.

Once you are satisfied with the shape, extrude it downward once and close off the

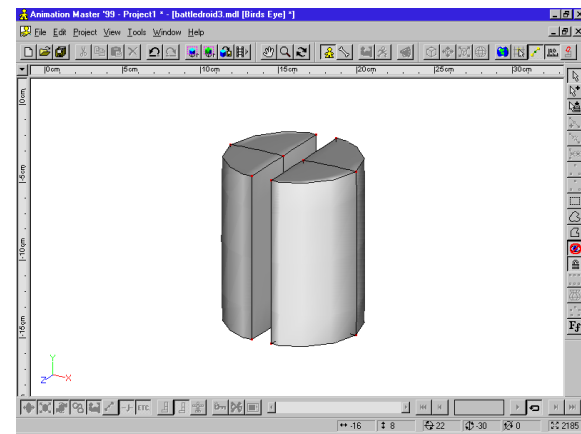


Figure 9: The eye we'll use to make a boolean cuts out of the head.

other end (figure 9). This will create two closed shapes. Get rid of the round ends by clicking on the lengthwise edge of the splines and setting the magnitude to 0 (it will default to 5.0, which is normal).

Scale the completed shapes and position them over one side of the head where you want the eye to go – they should protrude a bit above the top of the head. Create a copy for the other side of the head, then switch to bones mode. Create a bone down the center of the head, and then click on it to select it. Draw four bones, children of the head bone, one inside each of the eye shapes. Make sure they each fit inside their respective shapes and assign points to them. Click on boolean cutter in the properties for each bone. You should now see the holes cut for the eyes if you do a test render.

Neck

There are three parts that make up the neck – a split section in front, one thin section at the back, and a bolt passing through the top center. We'll make one half of the front section first.

We only need to extrude a simple, rectangular shape for this part. You need eight points for the cross-section, two at each corner, since the edges shouldn't be absolutely sharp. Just extrude it straight down, and then scale the top and bottom on the X-axis so it looks like (figure 10). Notice where the cross-sections were placed in the figure – this makes it easier to adjust the shape.

Create a duplicate and flip it on the X-axis to go on the other side, and then rotate the completed shape so that it tilts back about 20-degrees. Make another cross-section for the back and extrude it back from the top and then straight down near the bottom of the front section so that it looks like figure 11.

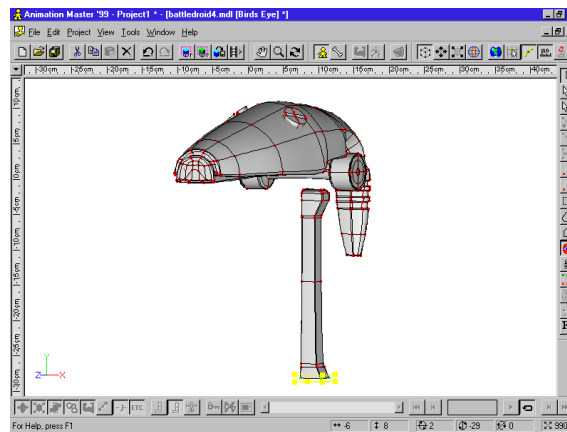


Figure 10: Main part of the neck.

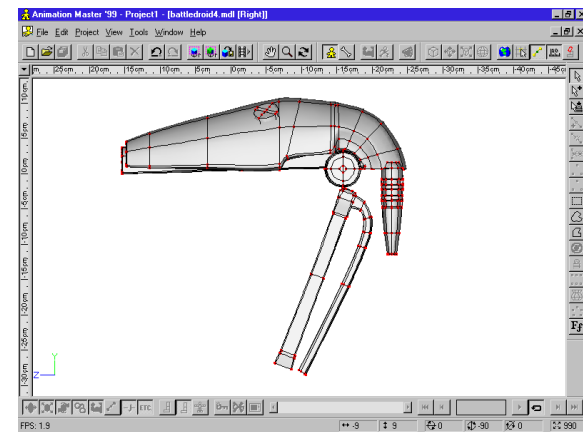


Figure 11: The back part of the neck.

Making the body

Torso

I decided to treat the torso as a multi-sectional part to make it less complicated to model. The middle section of the chest is rather simple but it can be hard to decide where to start. One might be inclined to try making a number of shapes and try lofting them, but this can be very time-consuming and it's hard to get an impression of the model while you are doing it. A cross-section of the area drawn in the top view will make a good rough shape if extruded and will give you an idea of where things are headed from the start.

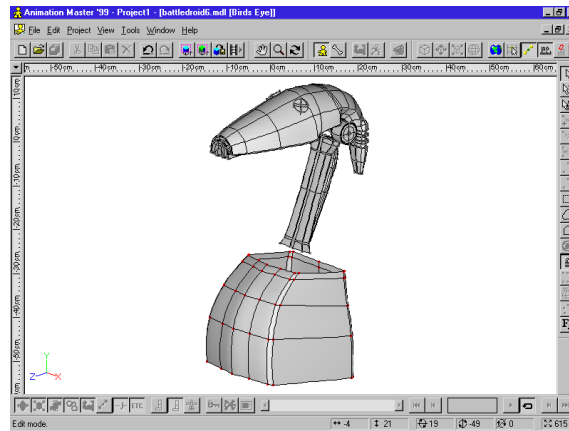


Figure 12: Extruded chest shape.

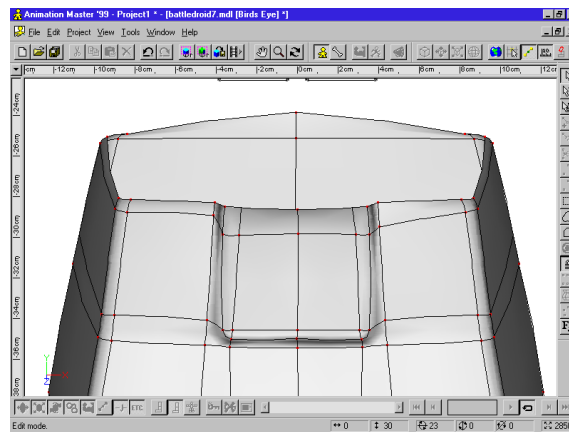


Figure 13: Adding points for the U-shaped indentation around the neck.

Create a shape similar to the one we used for the neck – only on a larger scale – and center it below the neck. Extrude it a few times and scale the sections so that it narrows slightly towards the top. Move the points in a side view so that the front curves out and then tapers in sharply near the top. The bottom should be higher at the front, but the back should be straight (figure 12).

Now there are a few small details we need to work into our torso object. Around the neck there is a U-shape that needs to be cut out of the chest. You need to make it smooth, note how I added points in this area so that the two lower corners meet using 5-point

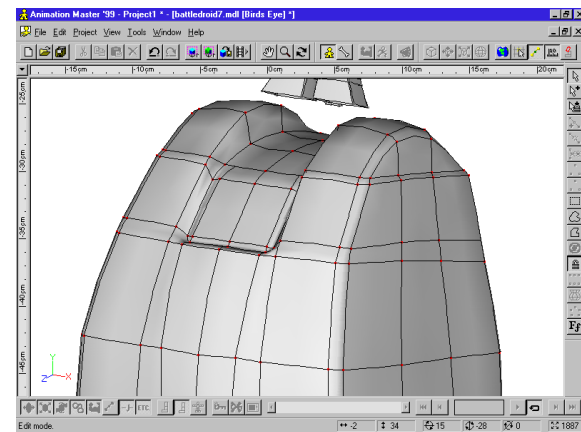


Figure 14: Curves above the shoulders.

patches (figure 13). All that's left after that is to move the inner spline back a little and maybe extrude it once.

The top is rounded and arcs over the shoulders on either side of the body. This part will require adding a number of points, so just work on one side of the body. Generally, you just need to add a spline or two down the center and connect the front and back to this (figure 14). When you have finished on the one side, delete the other half and then copy the completed side, flip and attach the copy.

Next we want to select the bottom row of points on the chest, extrude it, then scale the new section a little smaller. Make another and scale it just slightly smaller than the last, and then extrude it straight down. Work the shape straight in at this point and close off the bottom by drawing splines across it. Extrude the bottom straight down and then make the part above this hang down at the back (figure 15).

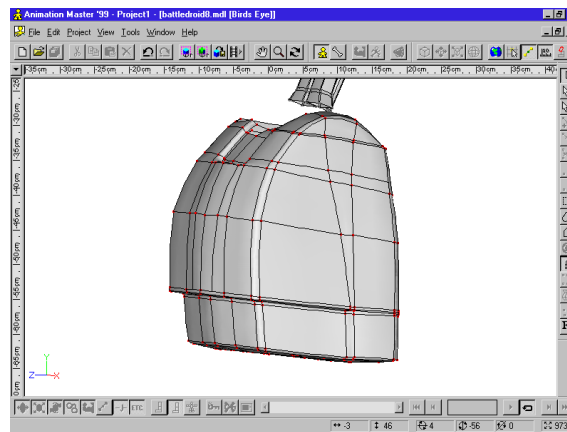


Figure 15: Extrude the chest further and adjust points in the back.

Shoulders

Create the shoulder using a simple circle like we used for the bolt under the head. It should only require about 6 extrusions away from the body, with a smaller section included about two-thirds of the way out to make it look like it is composed of two shapes. Taper the sections smaller the further away they are from the body (figure 16).

Backpack

This part requires about three steps. Start by making a closed profile curve in the right view port, and then switch to a front view and extrude it to the side so that the resultant shape is about the width of the body. Draw splines across the opening to close off the surface but leave the

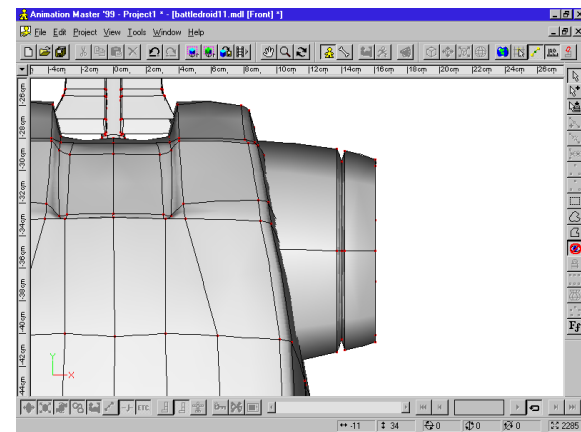


Figure 16: A circle extruded to form the shoulder.

top corners open (figure 17). Select the points that surround these two open areas, extrude them and scale the new sections a little smaller. Draw additional splines across the gaps so that it looks like figure 18.

Now we need to make two antennae. These go on the left side of the backpack and are easiest to create using another extruded cross-section, preferably one with only 4 points. To make one of them, simply extrude straight up a number of times and bunch the new sections near the top. Scale the top a little larger to create the bulge on the end of the antenna (figure 19). Create a copy and move it next to the first one you made.

Abdomen

There's a thin section between the chest and pelvis that is simple enough to create by making a cross-section that is

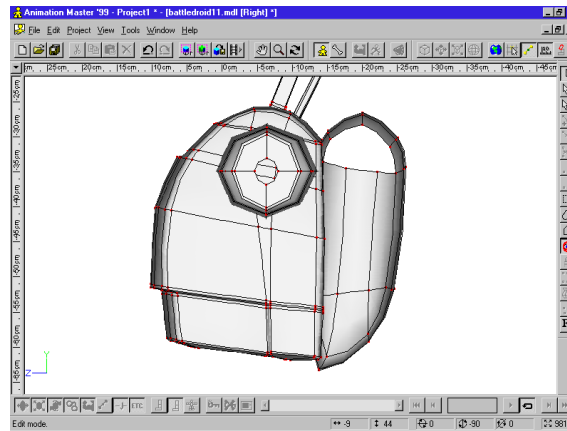


Figure 17: Backpack with splines drawn across the openings.

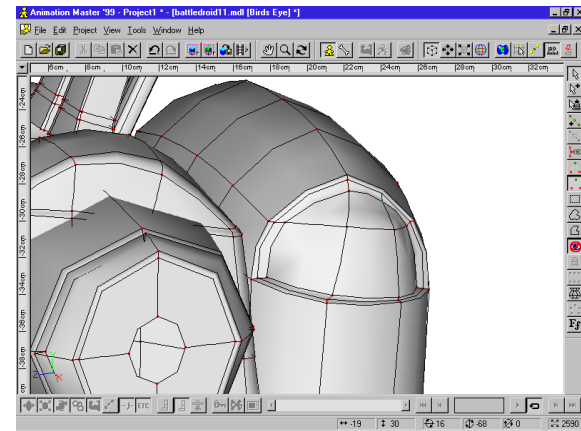


Figure 18: Openings scaled inward and closed off.

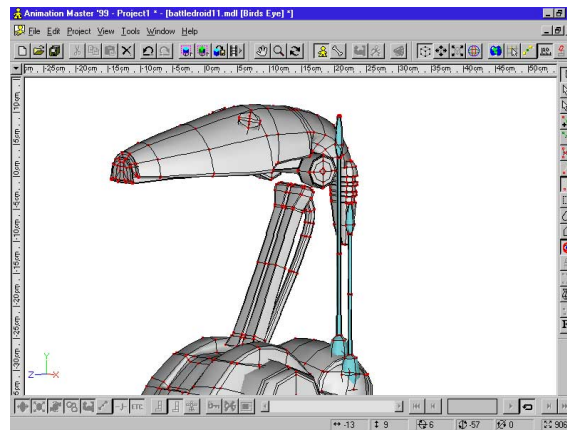


Figure 19: Antenna made by extruding a circle.

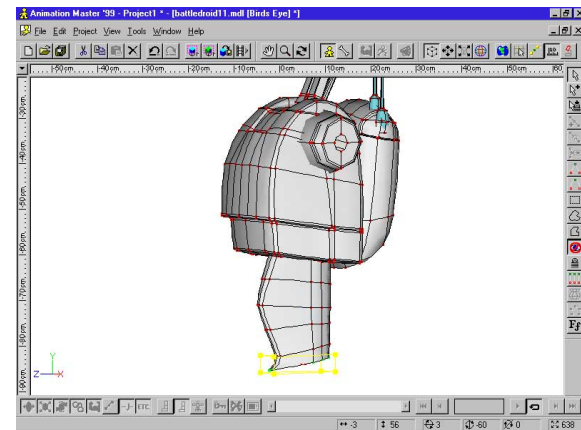


Figure 20: Abdomen.

narrow on the X-axis and extruding it straight down. It should be wider in the center than at the ends when looking at it from a side-view (figure 20).

Move the points on the front of this surface so that it tapers in towards the center and then goes straight down from there. For detail freaks, there is a little notch out of the back that you can prepare by bunching points together towards the back. Then group the inner points in this area and scale them slightly smaller on the X-axis (figure 21).

Pelvis and hip

The pelvis appears to wrap around the bottom of the abdomen. Create a profile curve in the right view port

and extrude it on the X-axis to create a surface about half as wide as the chest. Adjust the bias of the points so that the top is flat and the sides have a concave curvature (figure 22).

Next we'll close off the sides of the pelvis. Start by selecting the points on the edge and extrude about two or three times. Scale each new section smaller than the last and move them inwards to create a concave indentation on the side. You'll notice that the edge will be a little too round and the inner area will be too flat. Correct this by making the bias magnitude smaller along the edge and increasing it inside the concave area (figure 23).

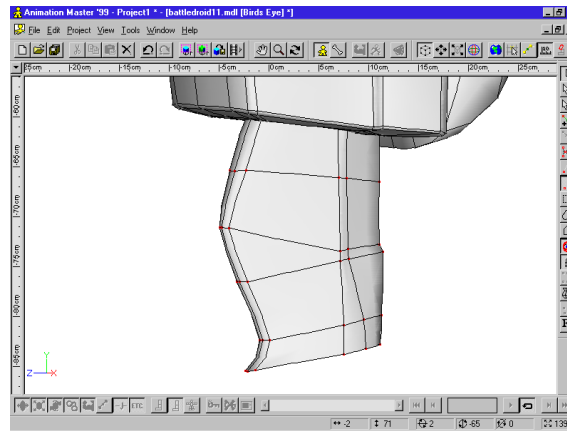


Figure 21: Indentation on the back of the abdomen.

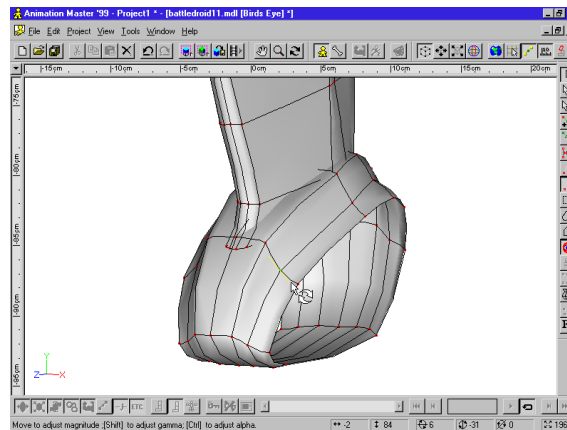


Figure 22: Rough shape of the pelvis.

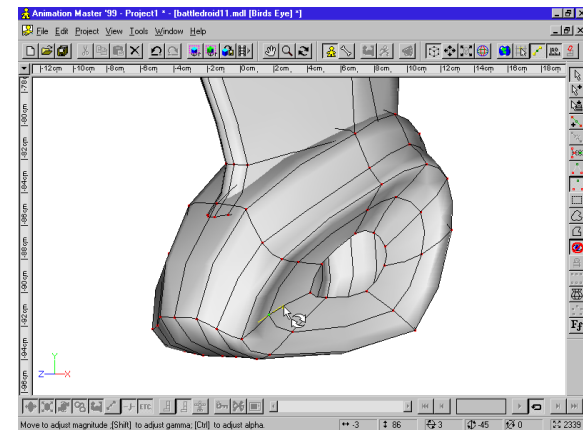


Figure 23: Concave area on sides of the pelvis.

Extrude a circle to make a pipe-like shape that passes through the center of the pelvis and protrudes slightly from each of the openings on the sides. On both ends of this “pipe” are little shapes similar to a top lying on its side. An extruded circle that is scaled smaller on the end should work fine for that part – you can just use the ends of the last shape we made for this (figure 24). This should be good until we move onto the legs later.

Supports

Our last detail on the main part of the body is the little supports that connect the abdomen to the chest. Like several other parts we’ve done already, we want to keep the geometry simple by extruding a 4-point circle that has the bias adjusted to make it round. A bit of scaling and rotating of the extruded sections is all that’s needed to get the form shown in figure 25.

Adjust the bias handles on the lengthwise splines so that the angled areas look good. The control that this affords makes it pos-

sible to reduce the number of cross-sectional shapes, and the fewer patches in the end, the better. I find that people often use too many patches to construct a model. While detail requirements may vary, you still want to use the absolute minimum that it takes to get the resolution desired. Any more and you’re just making more work for yourself later.

Appendages

We have the most difficult parts of the model done and out of the way. So far our battle `droid isn’t very scary looking – Jar Jar sure wouldn’t mind meeting this fellow on the field of battle. A couple of arms and legs are all it should take to get this `droid up and kicking some

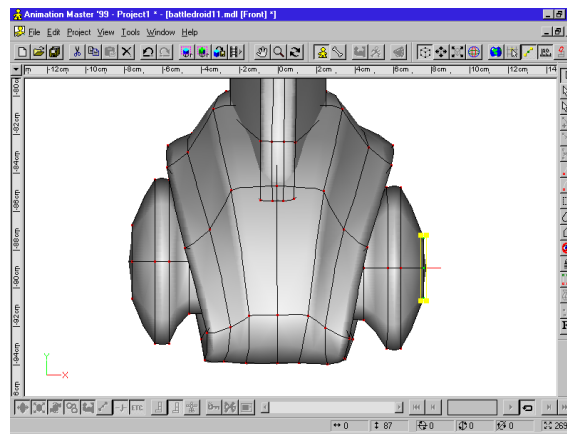


Figure 24: The hip bolt.

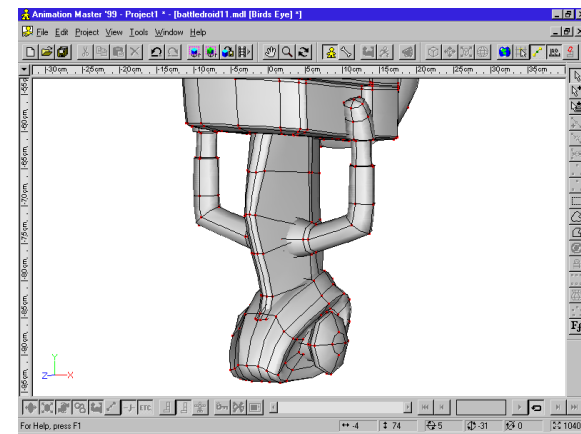


Figure 25: Supports connecting the abdomen to the chest.

Gungan's rear! The arms and legs are made up of numerous, simple shapes, none of which are very difficult to model.

Arm

The construction of where the arm meets the body is quite simple – extrude a spline like we've done in the other parts of this tutorial. Since the profile shape of this part is all you need I won't provide a separate figure for it. Refer to [figure 26](#) for this part.

There's two main parts to the upper arm. You can make the main portion of it by extruding a rectangular shape that has rounded corners – the shape should match the bottom of the last section we made. Extrude it so there are more points near the top and have it extend down to the bottom of the chest. Pull the points on the outside of the upper portion away from the arm and tweak them to look like [figure 26](#).

The other part of the upper arm is some

kind of hydraulic device that goes on the top of the upper arm. Extrude a circle to create a short section near the end of the arm and create another, longer section that extends from the shoulder to the center of the upper arm. Then make one last section between these two that will represent the metal rod inside the hydraulic apparatus ([figure 27](#)).

We'll be making a disc to represent the elbow. Make a copy of one of the 4-point circles that you made before to extrude this shape. You'll need to build a ridge around the edge. Try to get the top somewhat flat so that single spline drawn across the hole will close it without much visible creasing. Create a copy of this disc, flip it on the X-axis, and then move it to the other side of the arm

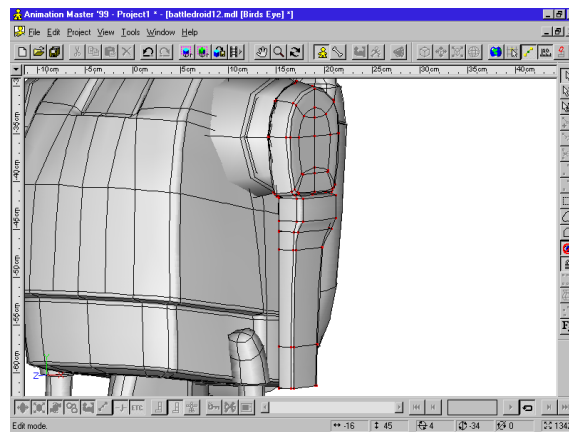


Figure 26: Upper arm and shoulder.

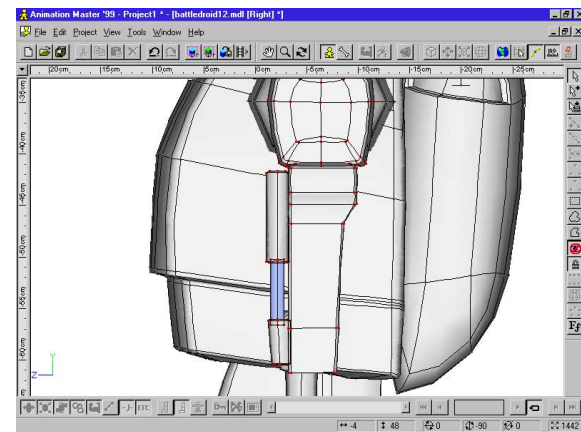


Figure 27: Hydraulic apparatus on upper arm.

(figure 28). You can finish this part off by drawing 4 new splines connecting the two halves. We will use this shape again in the legs.

The forearm is composed of a center section at the base that is surrounded by two supports, which leave an open area between most of this section. Create a copy of the bottom part of the upper arm and extrude this a short distance down from the bottom of the elbow. Then extrude an oval shape to create the central support of the upper arm (figure 29). Use a circle to make the outer supports for the lower arm, and scale the cross-sections so they taper at the ends (figure 30).

Hands

Make the wrist and base of the hand to act as the foundation for the rest of the hand. These can be quite simple since we will be layering more parts on top of them. Just

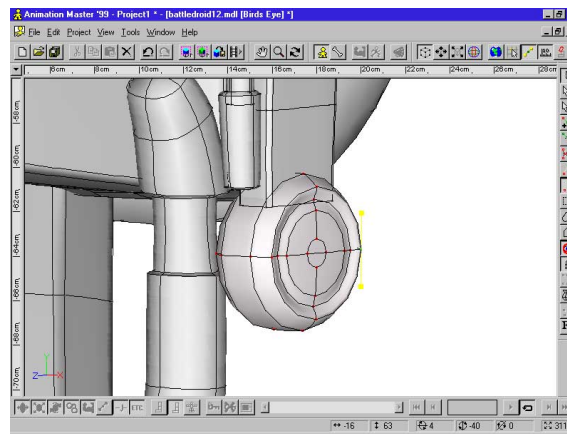


Figure 28: The elbow disc.

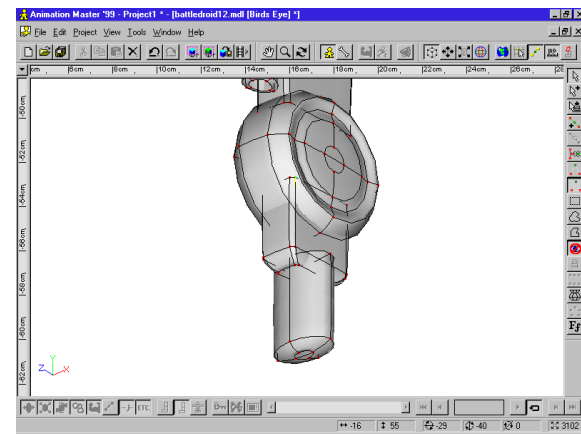


Figure 29: First parts of the lower arm.

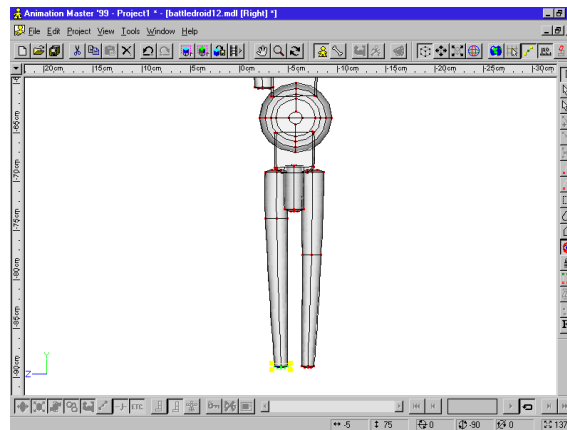


Figure 30: Outer parts to the lower arm.

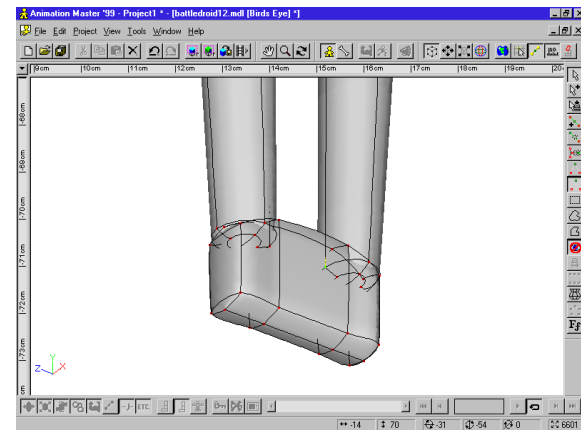


Figure 31: Starting the hand.

draw a somewhat square cross-sectional spline in a front view, and then extrude it back so it is a little less than the width of the arm. Close off the open ends by connecting new splines across them and adjust the bias to emphasize the edges. This part will make the wrist (figure 31).

Create a duplicate of the wrist and drag it down a little to where the hand should end. Break a few splines on the edge facing the ridge but leave the center of this area intact. Then extrude the two open areas back until they intersect the wrist. The result should be similar to (figure 32).

Now we'll move onto the fingers. Make a simpler version of the disc we made for the elbow. We can use copies of this to form all of the joints in the wrist, hand, and fingers (about six). Then extrude a square section into a rectangular shape. You need two copies each of this last part for the two fingers and the thumb. Figure 33 shows how all these parts are laid out to make the hand.

You might be looking at the figure and thinking it needs more explanation, but if I were to show any more figures it would end up seeming rather redundant. Just focus on the top and imagine putting them all into place. The parts making up the tips of the fingers need to be scaled a little bit smaller than the ones at the base of the finger. The whole process shouldn't take more than a few minutes, though you should take your time separating the parts into groups for selection later.

Legs

Create a copy of the disc we created for the elbow and place it next to the hip to form the upper part of the leg. It shouldn't need any alteration other than scaling it a little larger. Create the thigh by extruding another section

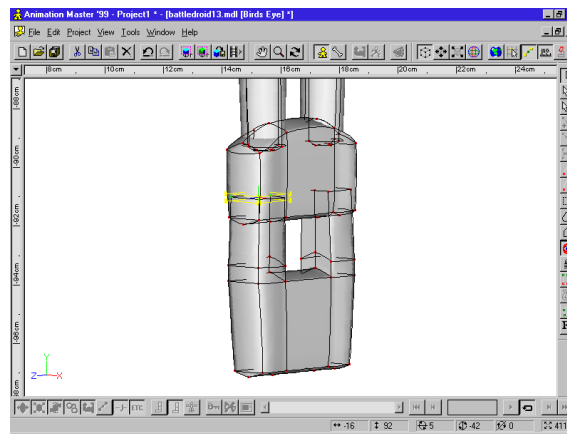


Figure 32: Foundation of the hand.

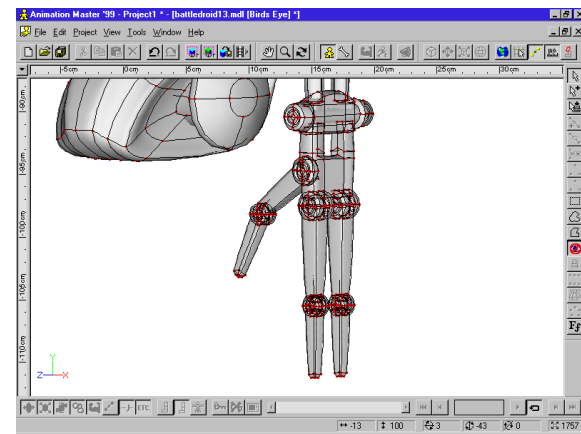


Figure 33: Layout of the hand.

similar to the way we did the upper arm, only pull the points on the inside of the leg near the top inward this time (figure 34). Some minor tweaks should give us some good detail in this area. We can copy the disc we used for the upper leg and place it at the bottom of the thigh to make the knee before moving onto the lower leg.

We are moving along pretty well now, but the lower leg is going to require a little extra work. It is shaped like a coffin standing on end when viewed from the front and has a little Y-shape on the sides. There is also a thin ridge running down the center of the front.

Begin by drawing a profile curve that includes the little square on the front and that

has about two points on each side. Adjust the bias handles in the front to flatten the edges (figure 35). Extrude this curve straight down leaving around three sections near the top and one or two at the bottom. Adjust the points to create the impression of an upside-down triangle on either side near the top (figure 36).

Feet

At long last we have reached the foot! Since we will hardly ever need to see the bottom of it, we can create it using one extruded cross-section. Just draw an outline of the foot in a top view and then extrude it upward a few times. Scale the sections a bit to taper it near the top and then tweak the points to

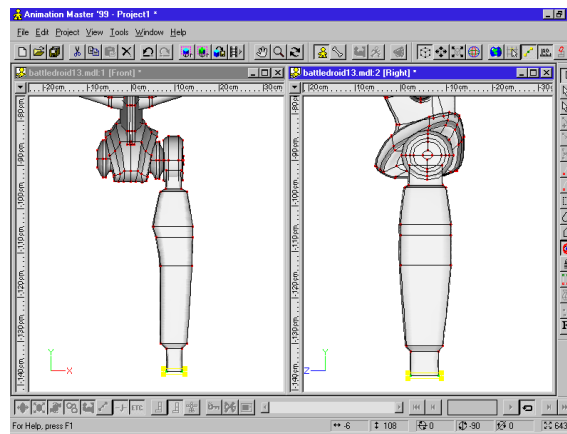


Figure 34: Extruded thigh section.

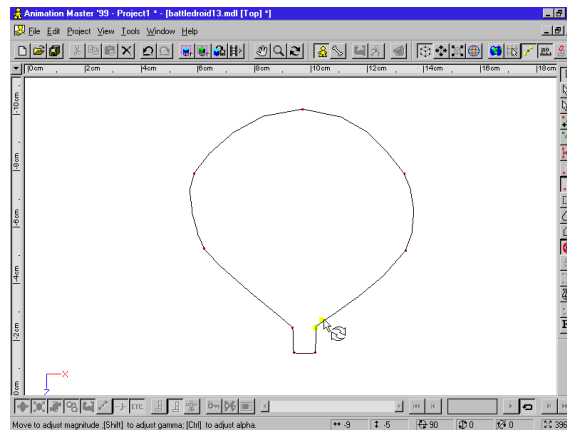


Figure 35: Cross-section for the lower leg.

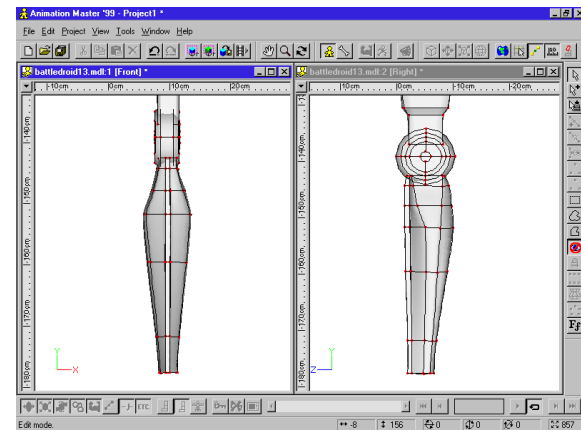


Figure 36: Front and side view of the lower leg.

get the shape right. The main things to look for are the instep and the widening of the foot above where the little toe would be. Cap off the top and bottom by adding splines across the openings (figure 37).

As a finishing touch you can add a copy of the knee to where the foot joins the leg to help smooth the transition. It should be scaled to about one third of the size but keep the length on the X-axis. And with that we are done modeling!

Closing

Given all the parts you need to assemble, the construction of the battle `droid can take a considerable amount of time. The completed model shown in figure 38 is just a hair shy of 4000 patches. Luckily none of the parts are actually attached to each other, so the bones setup is very simple. Just add them between points that would need to move and then hide everything but the geometry that should be at-

tached to a particular bone and select the points. Do this for all the parts until you can move the model in a pose window properly.

The surface finish properties I used are very simple. Make the specular size about 70 and the specular intensity about 70 as well. This will produce a nice plastic look. I also recommend turning the ambient down to 0, since you really should rely on lighting to provide all the illumination of your model.

Create a new material and add a dented texture to it. Set the weight near 50 to lessen the intensity of the bump effect then play with the amplitude multiplier to break up the surface a little. Add another attribute to the material and change the type to a Fractal sum combiner. Make

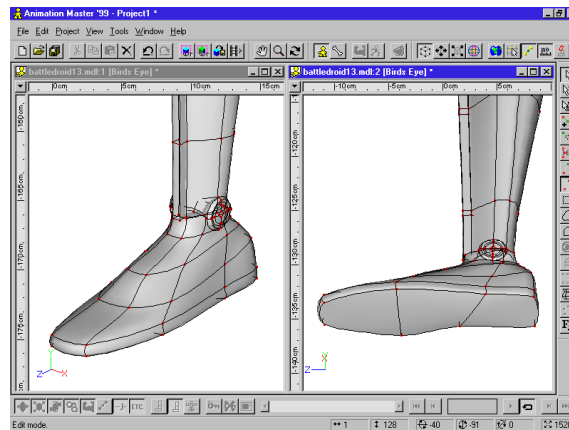


Figure 37: The foot.

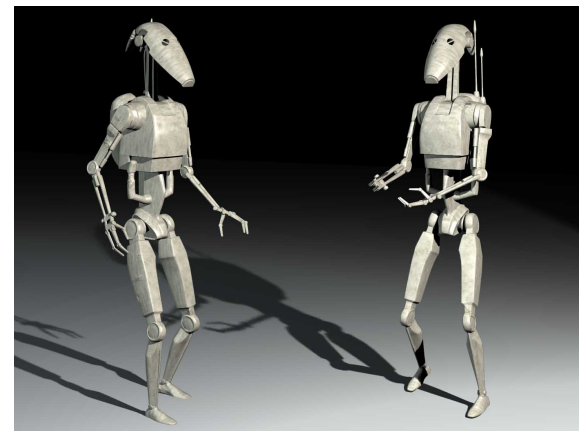


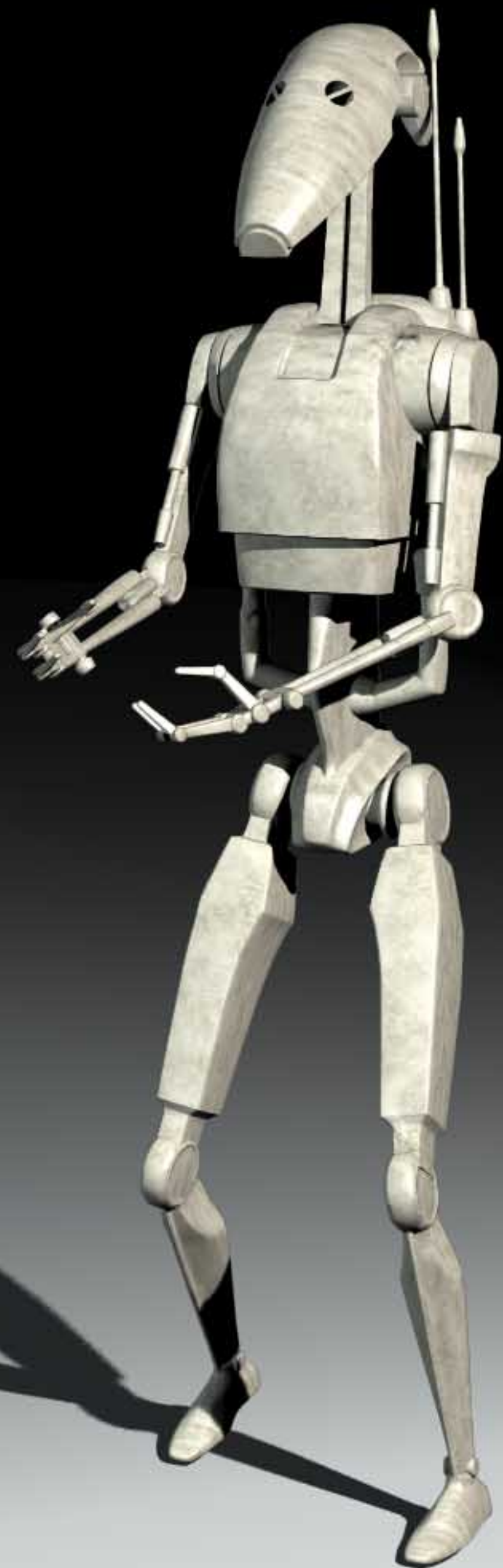
Figure 38: Completed model.

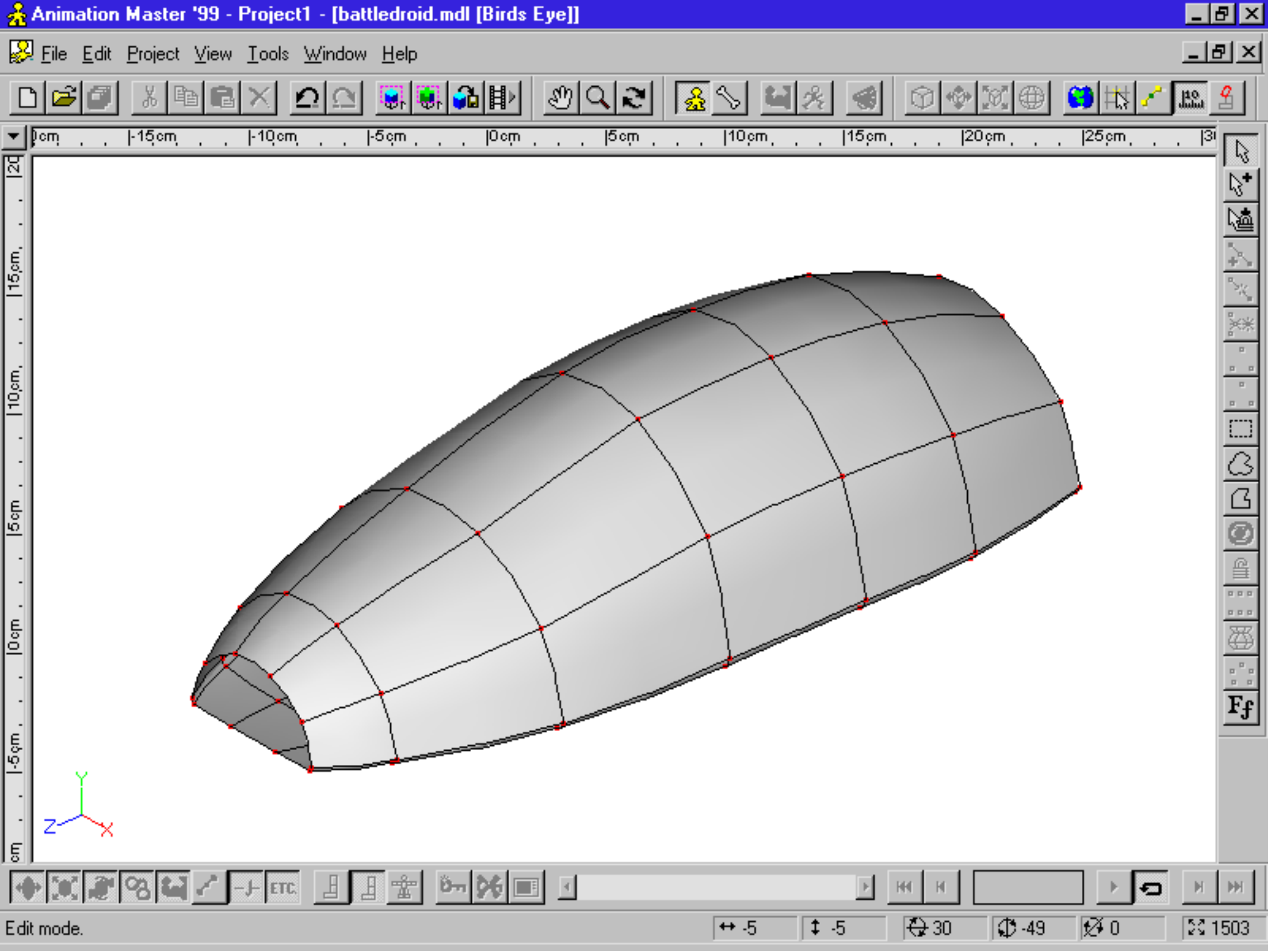
one color a light tan and change the other to another combiner. Use a similar off-white color in that channel and the result should be subtle variations in the surface color. Drop the new material onto the model to apply it.

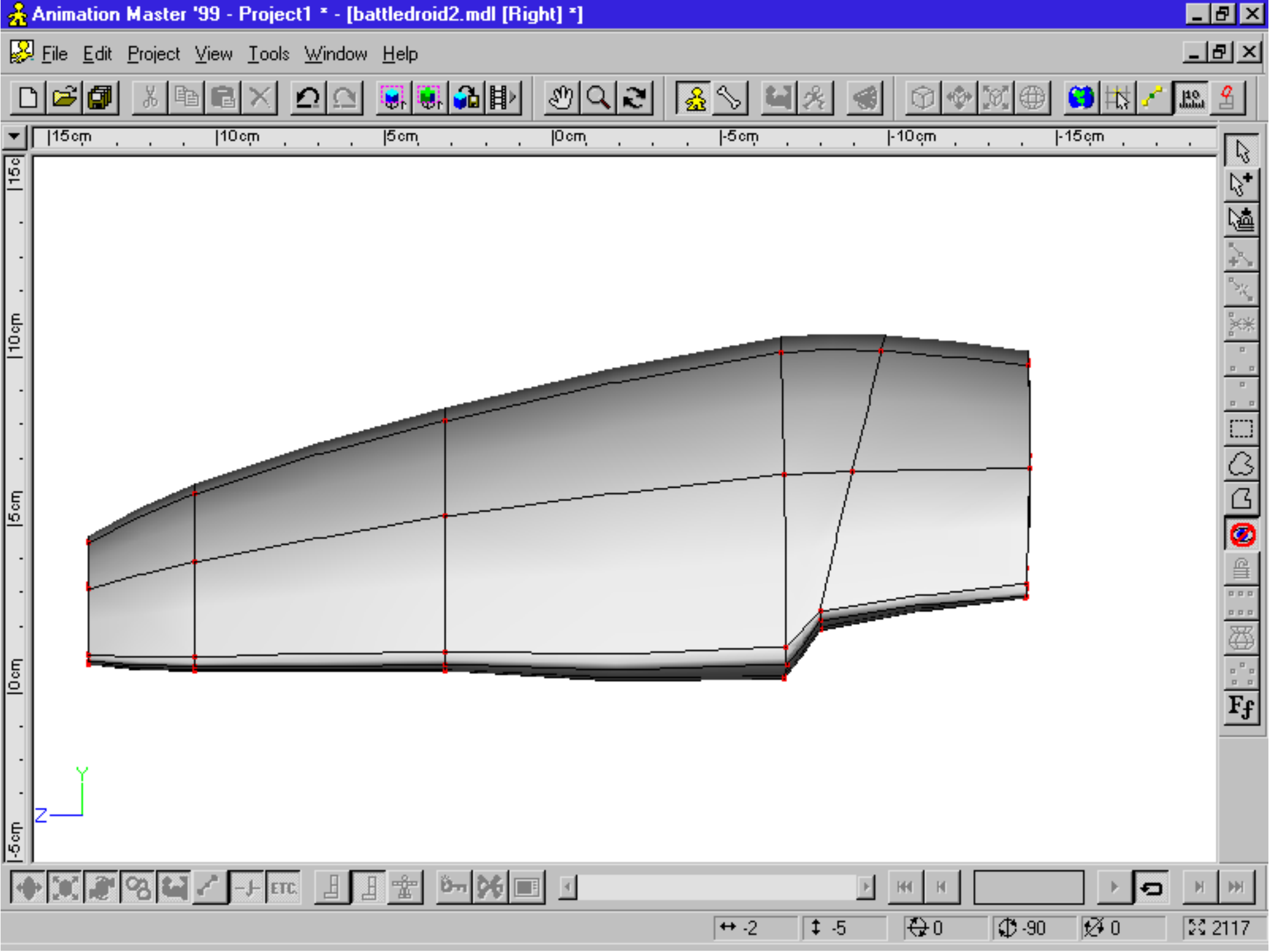
For more specific details you can apply bump and diffuse decals to different parts of the model. Look at some of my past articles for some good decaling tips.

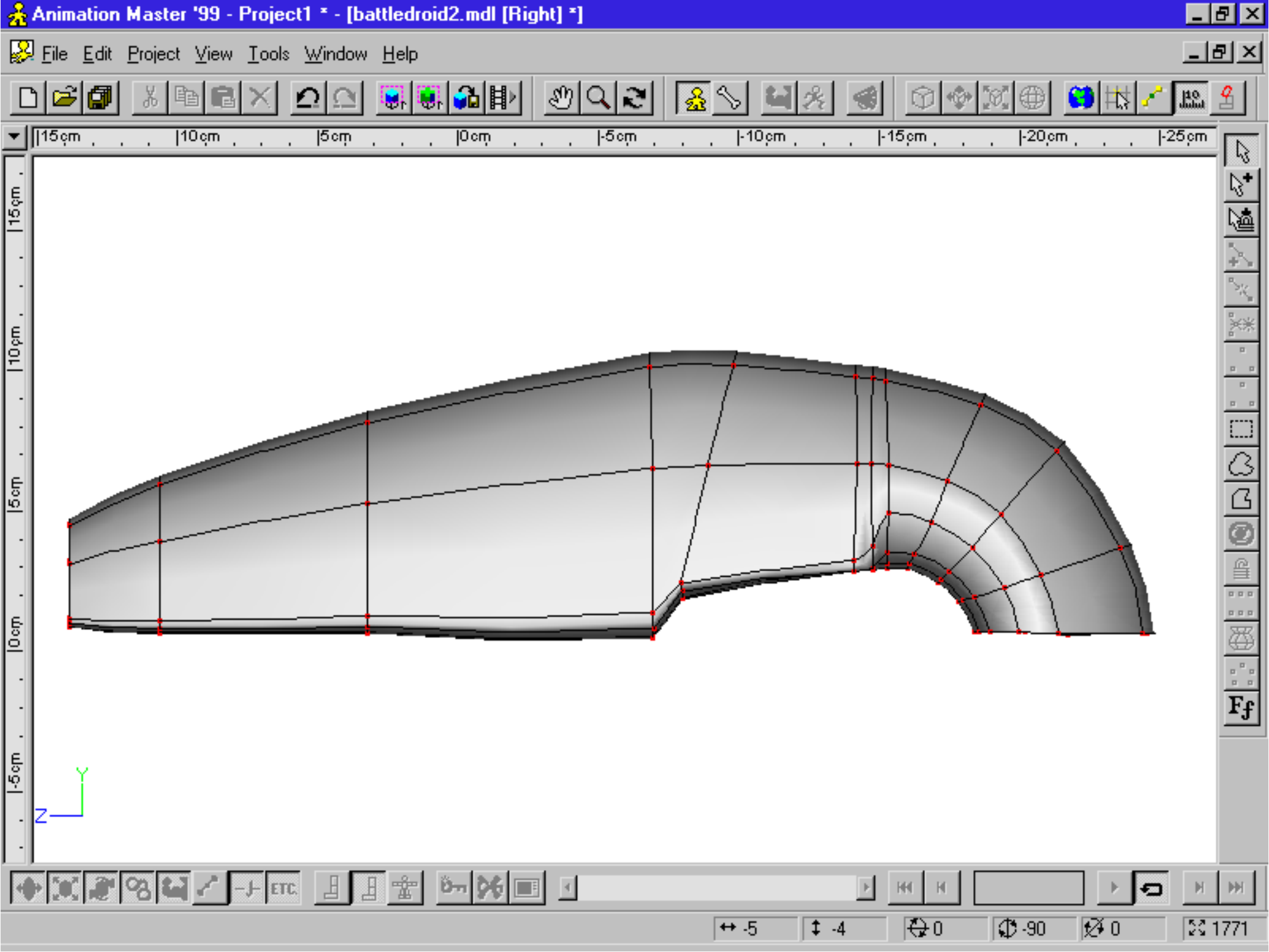
Biography

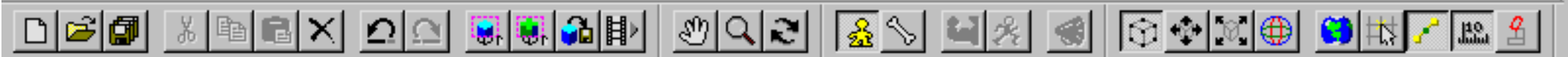
Mike is a freelance artist residing in Lindenhurst, IL. He was a painter prior to getting into 3D, and his artwork has been the focus of several exhibitions in southern New York. He switched to digital art shortly after receiving an Associate Degree in Fine Arts. He is a past winner of the Internet Ray Tracing Competition and currently a 3D rendering specialist for AOL's 3D SIG. You can see more of his artwork at <http://users.aol.com/pcrmikeh>. Mike can be reached at AmaltheaJ5@aol.com.



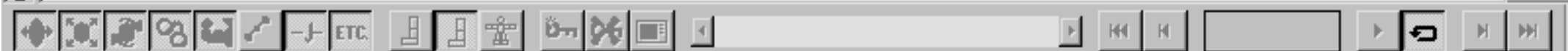
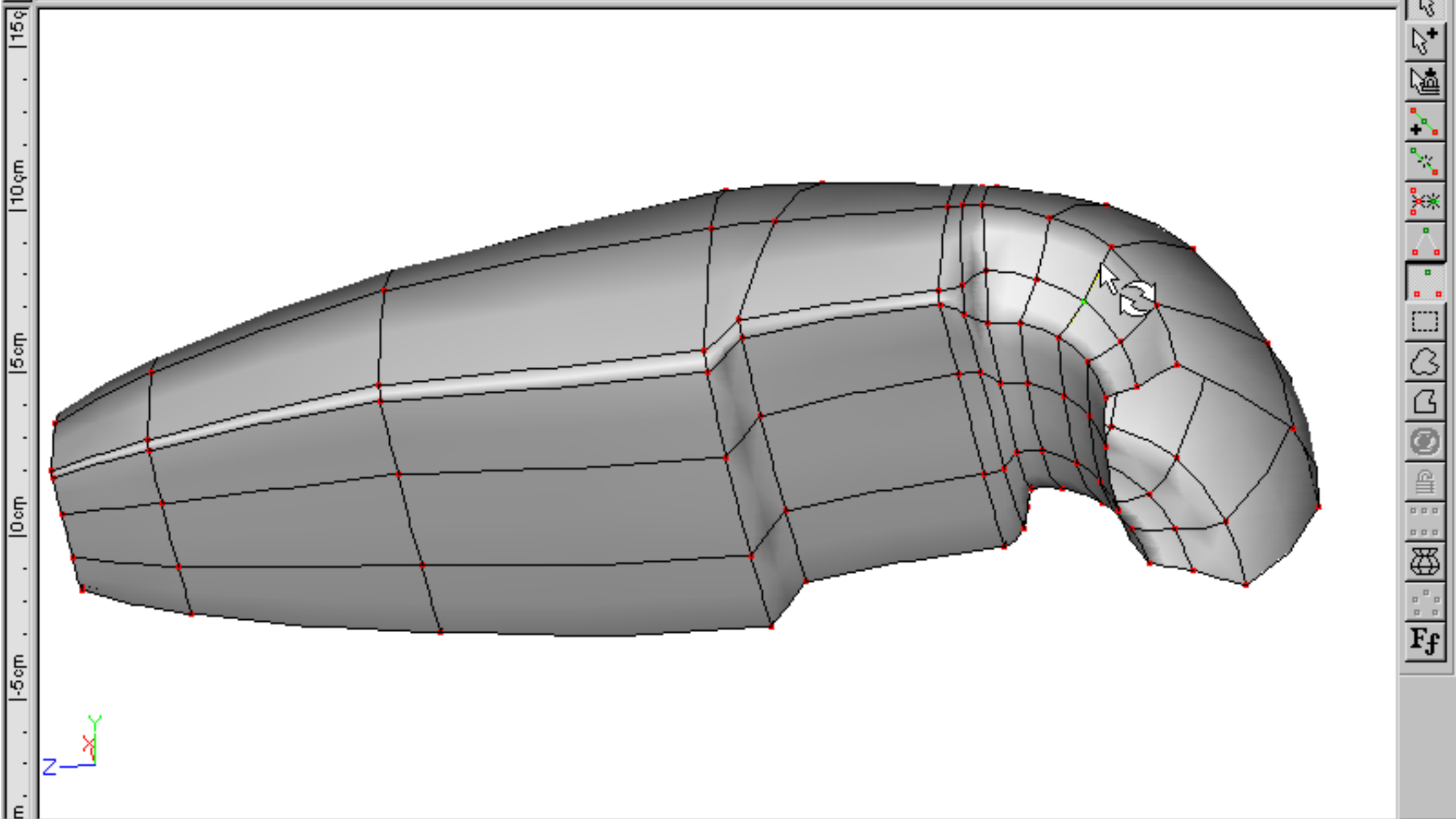






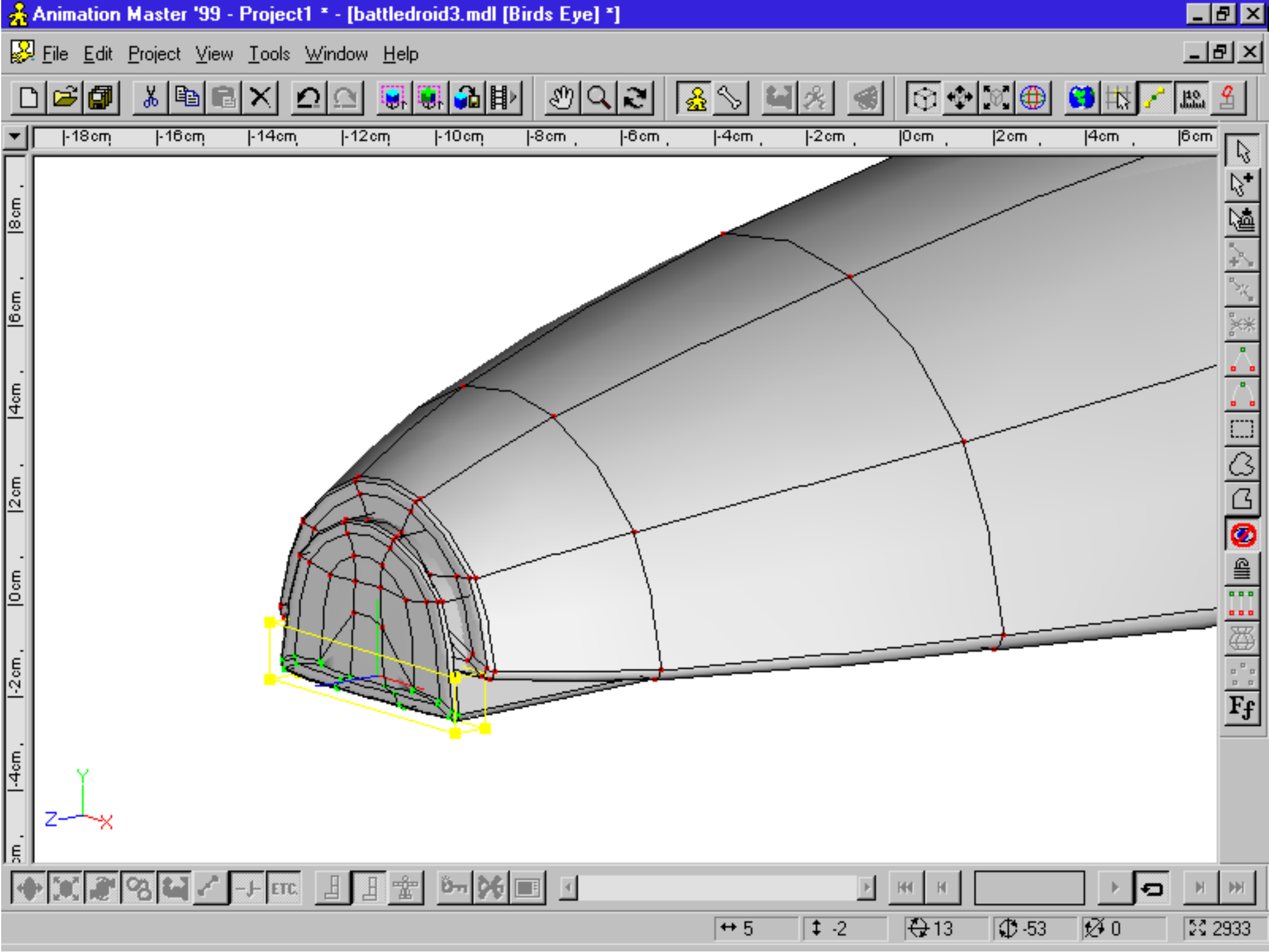


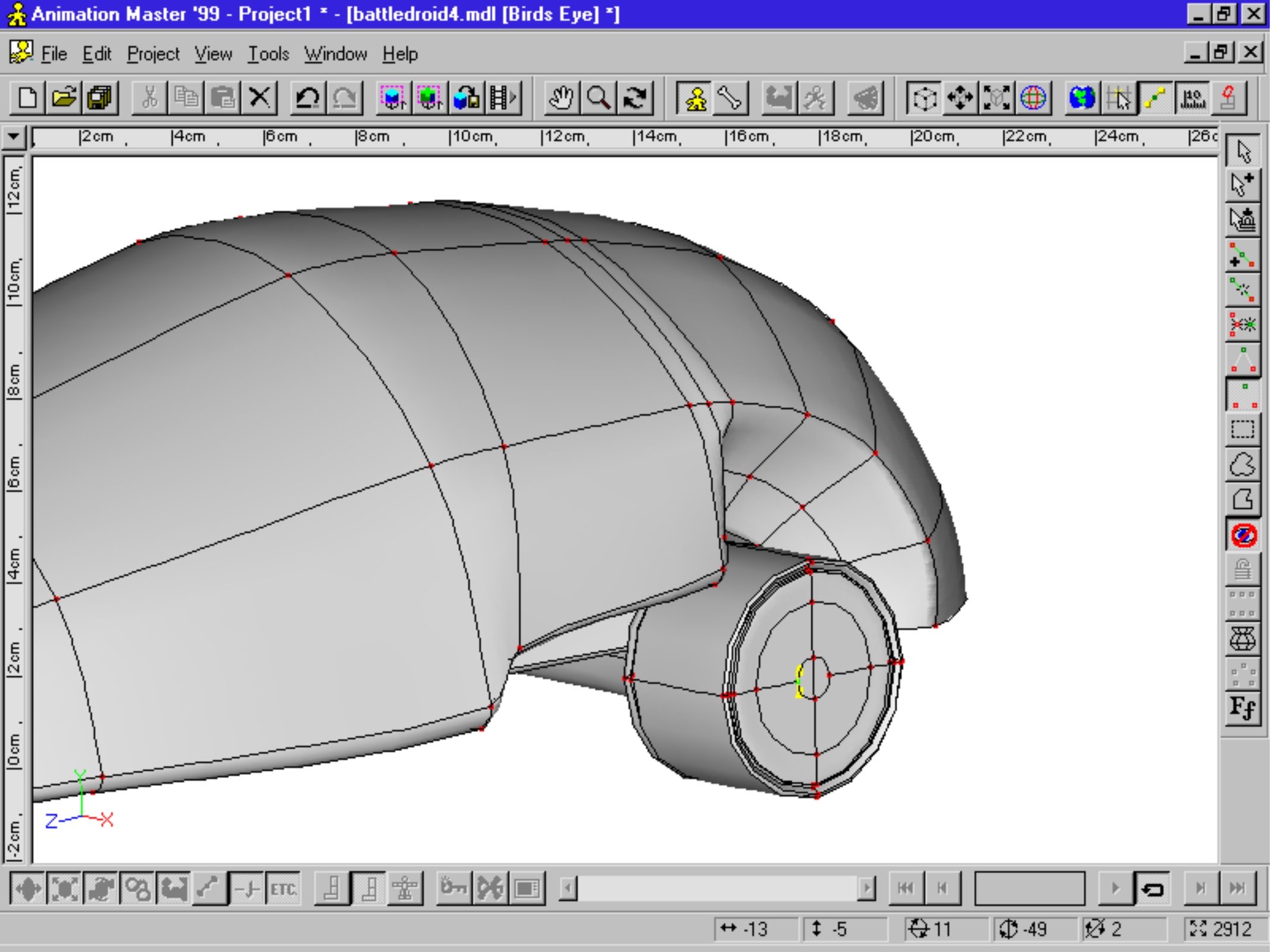
15cm . . . -10cm . . . -5cm . . . 0cm . . . 5cm . . . 10cm . . . 15cm . . . 20cm . . . 25cm

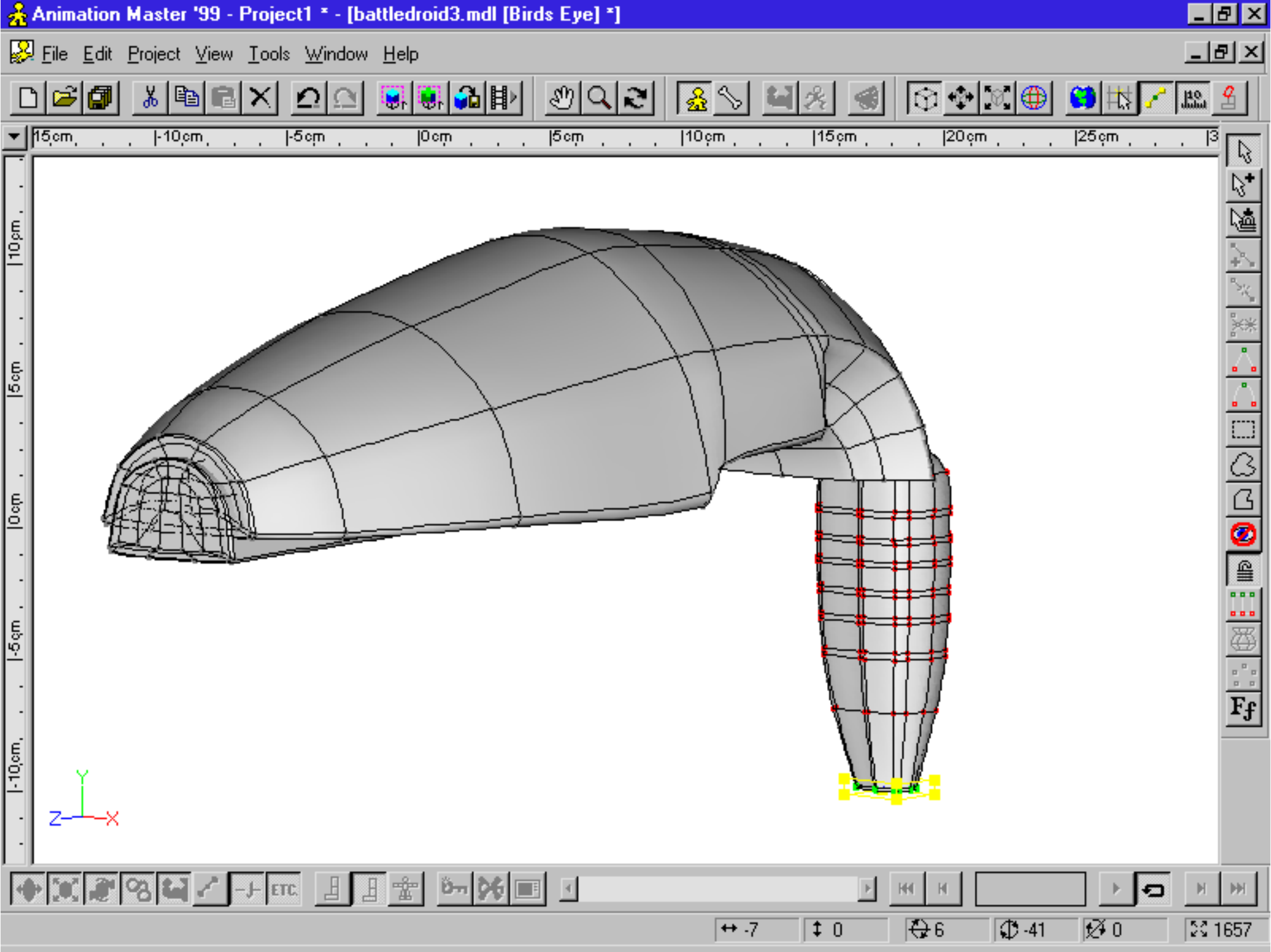


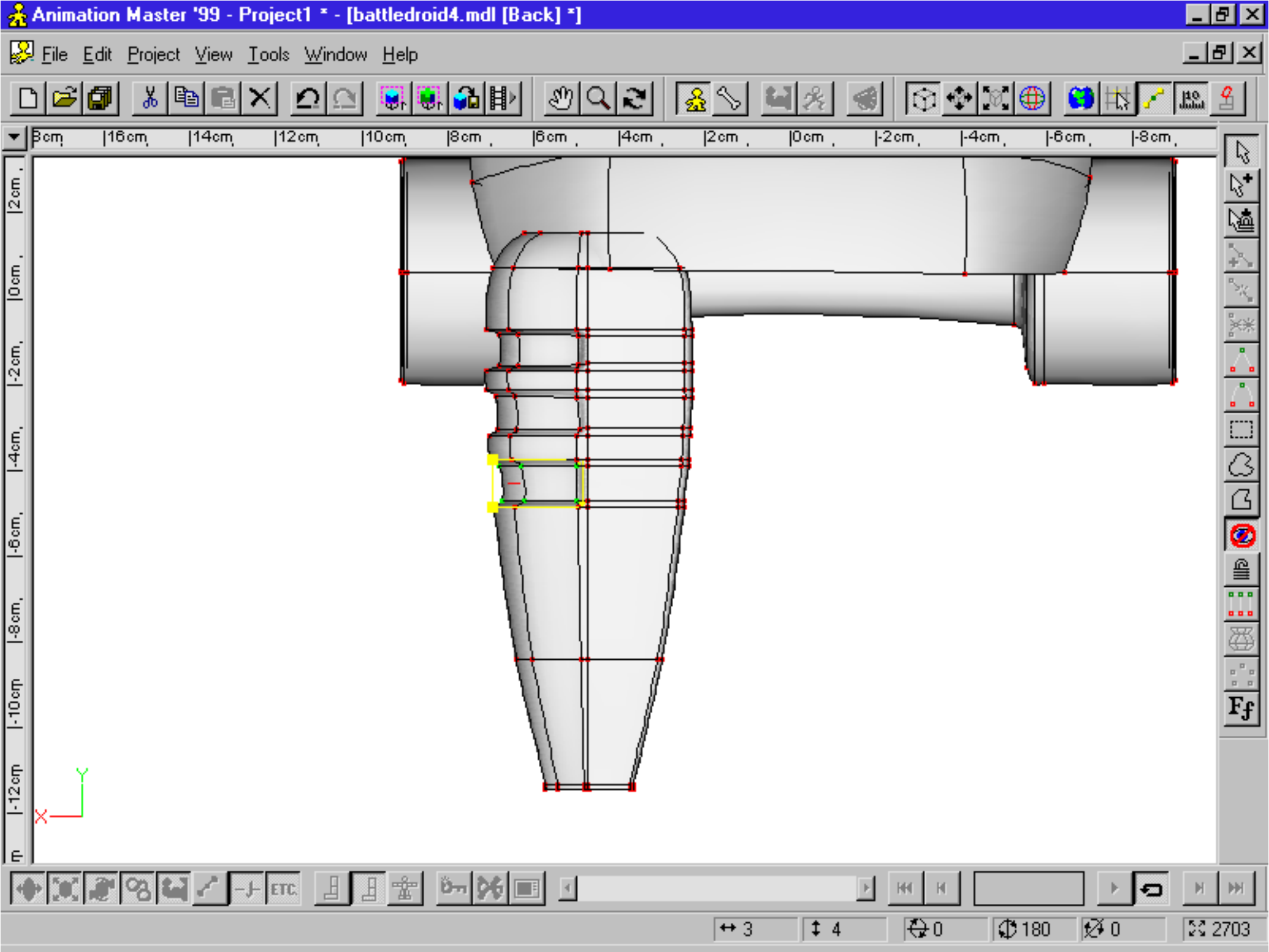
Move to adjust magnitude ;[Shift] to adjust gamma; [Ctrl] to adjust alpha.

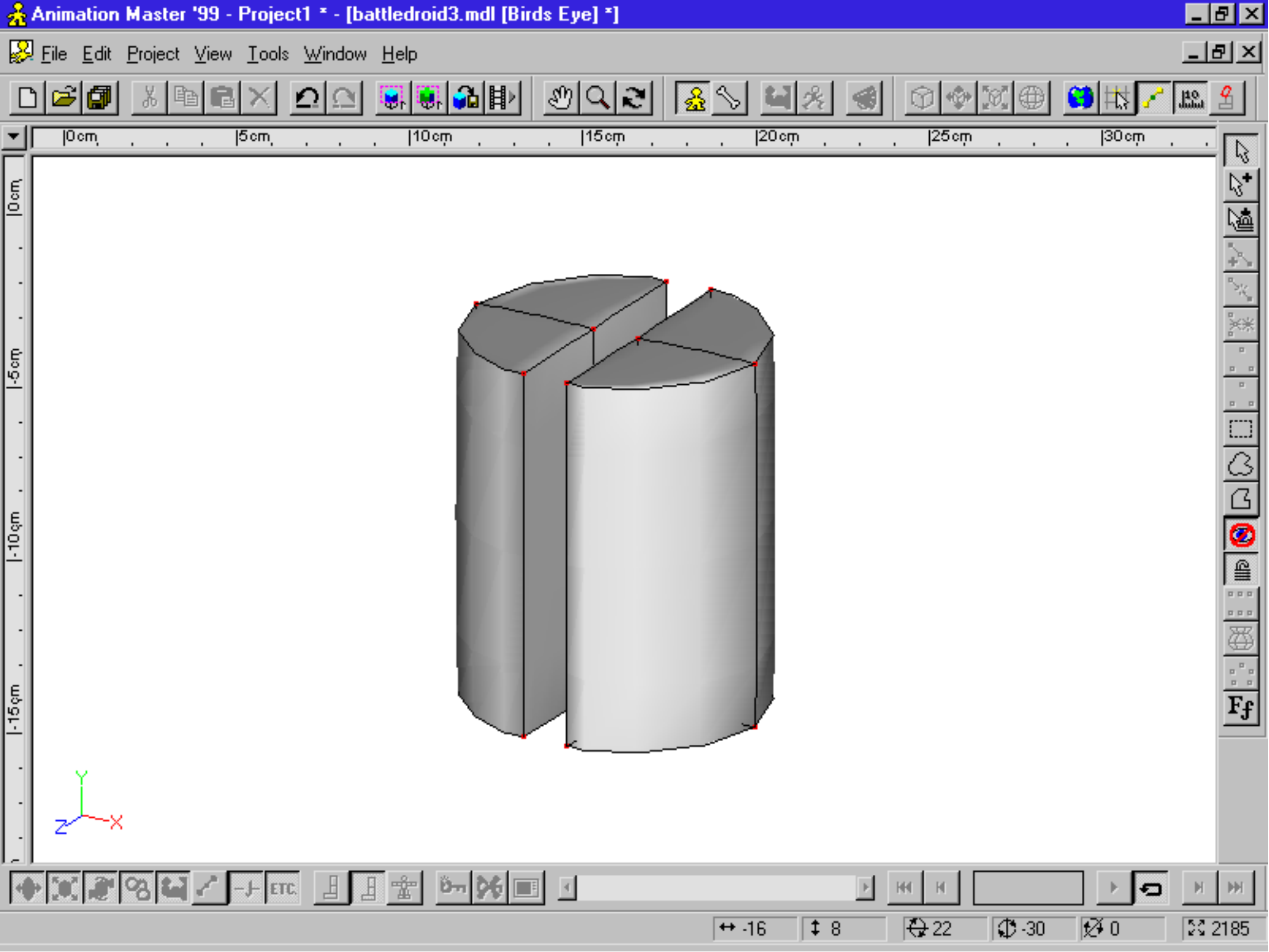
↔ -6 ↑ -3 ↻ -28 ↻ -97 ↻ 0 ↻ 1793

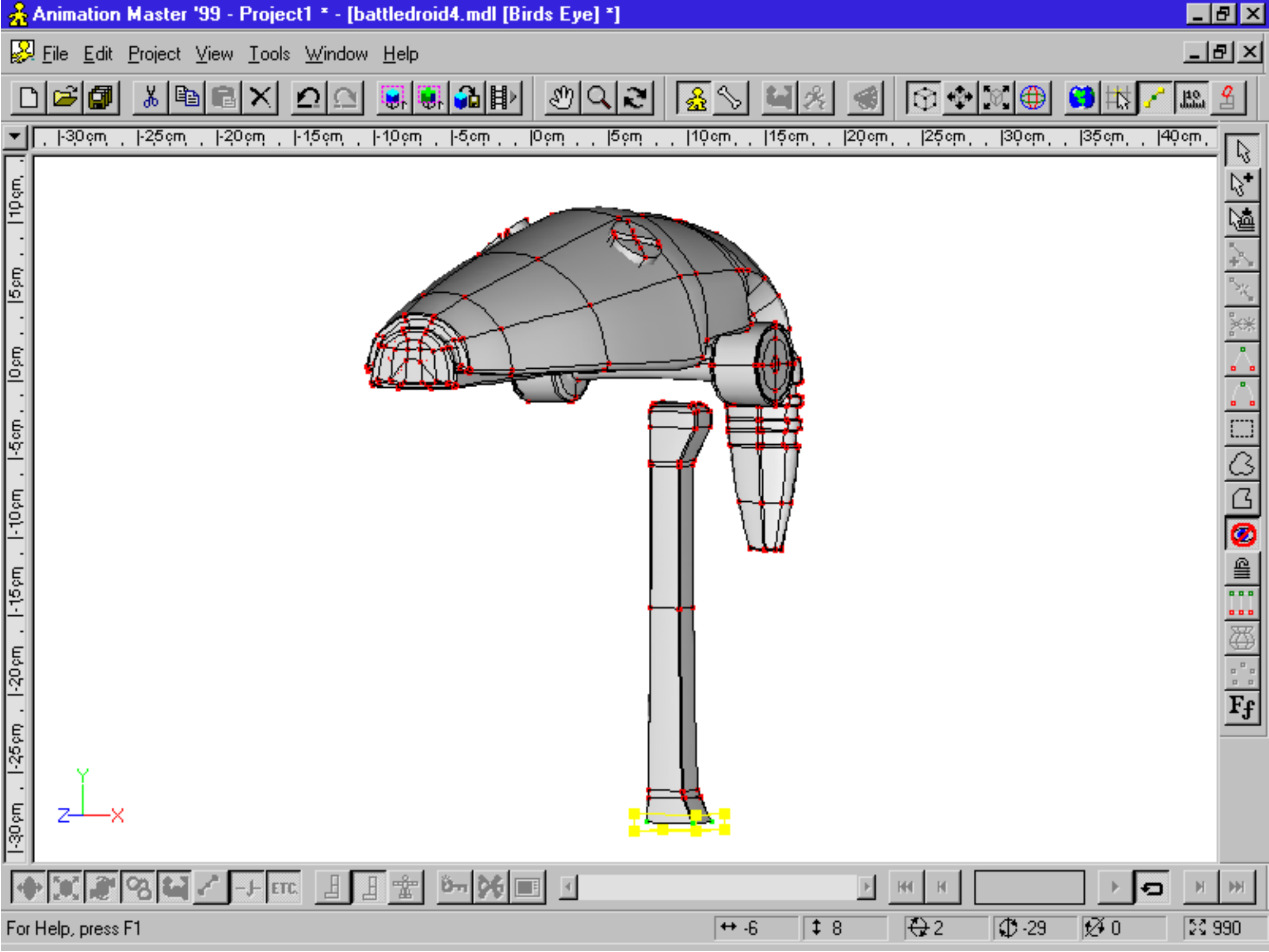


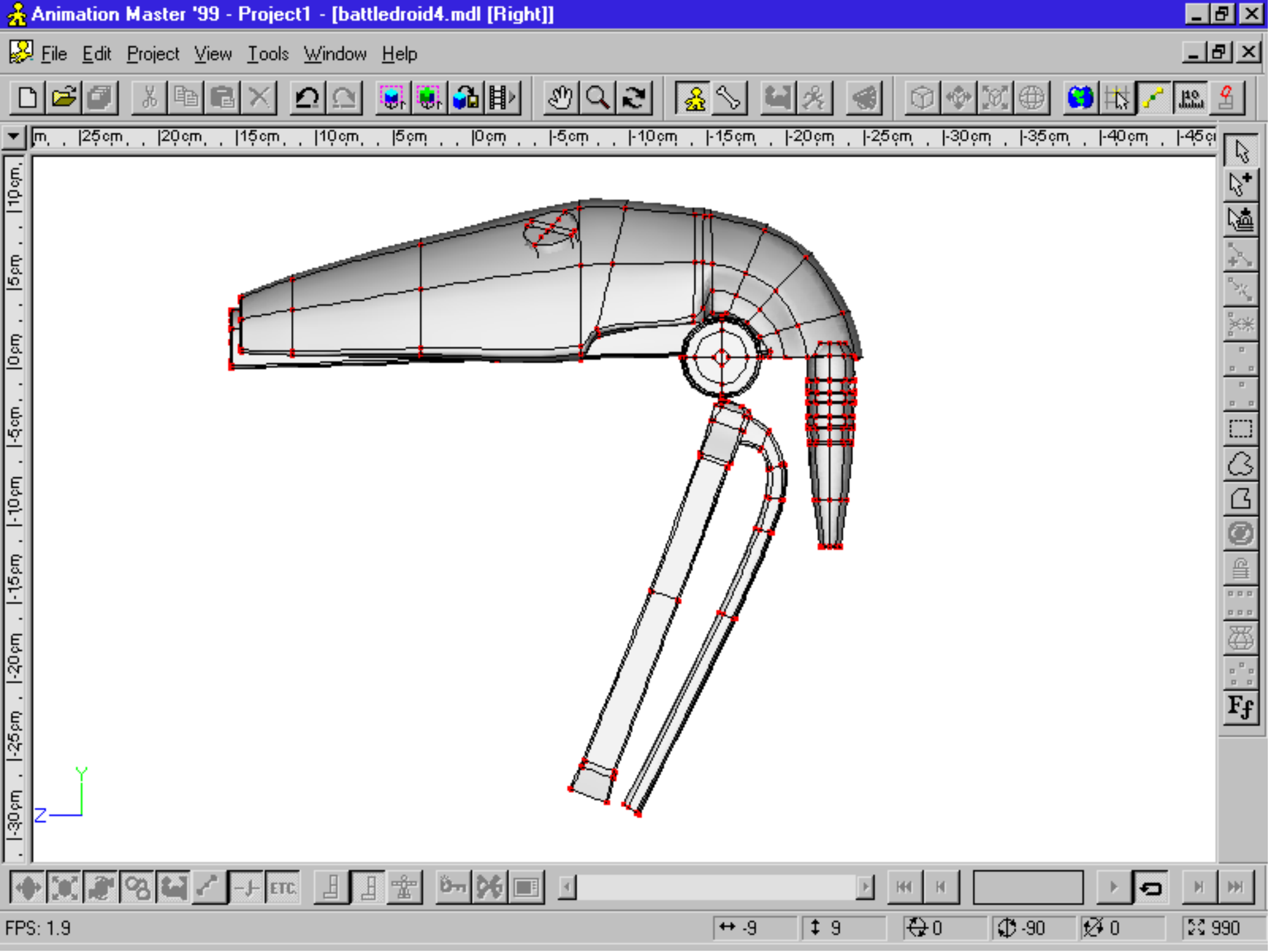


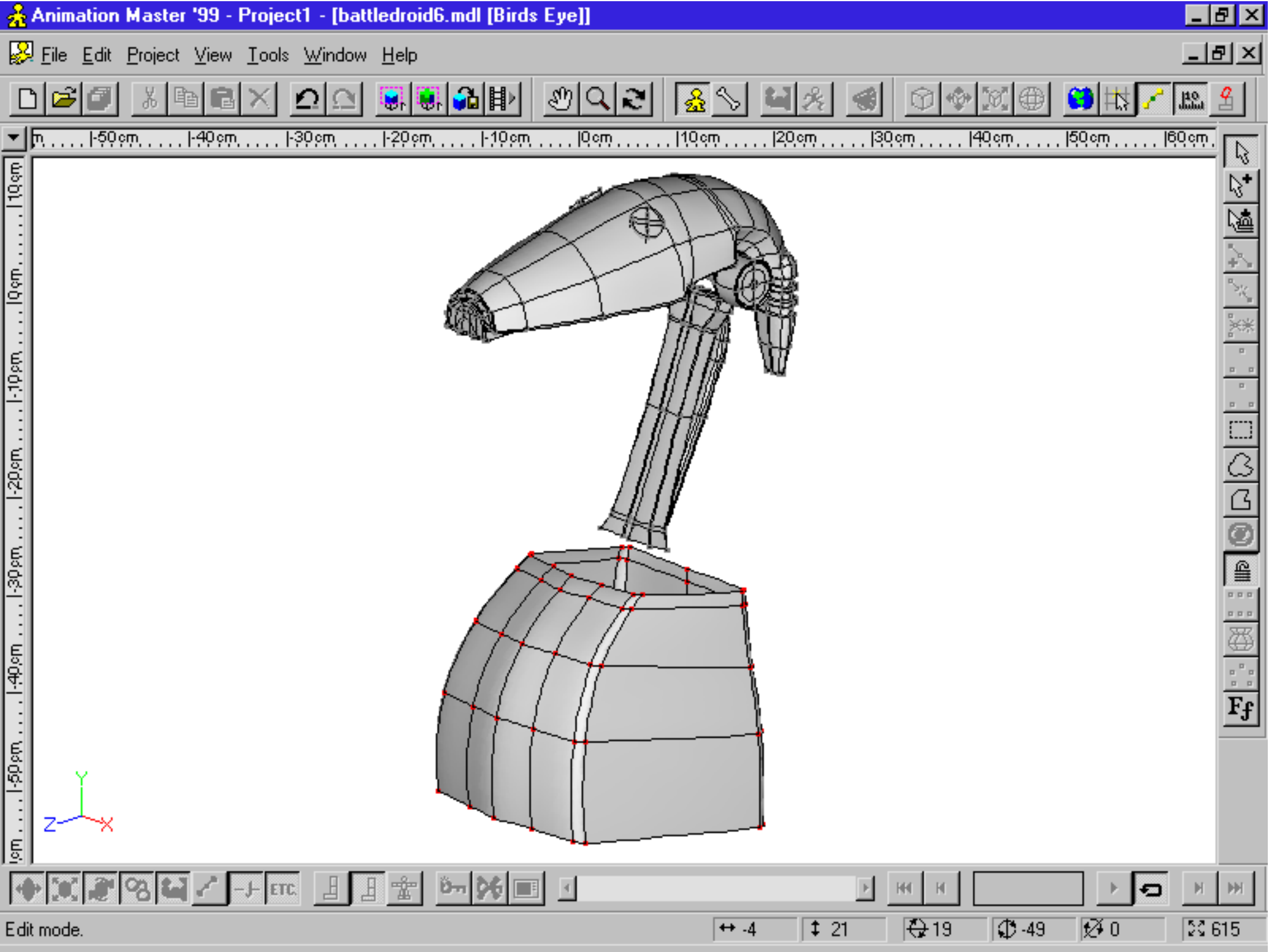


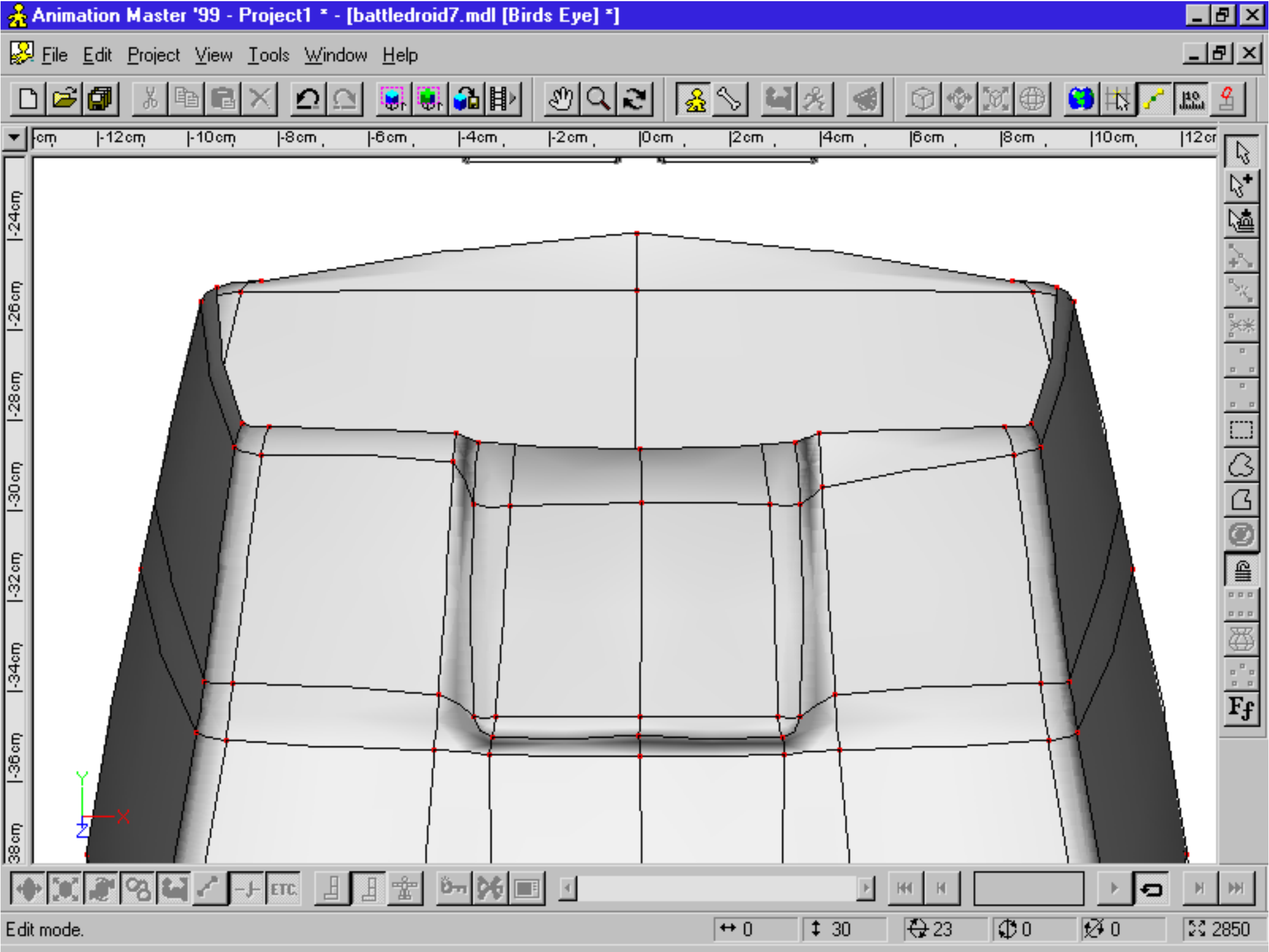


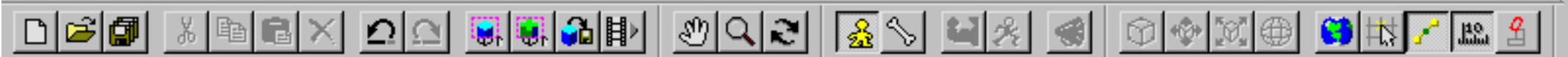




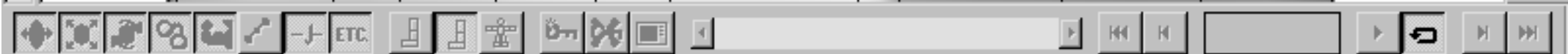
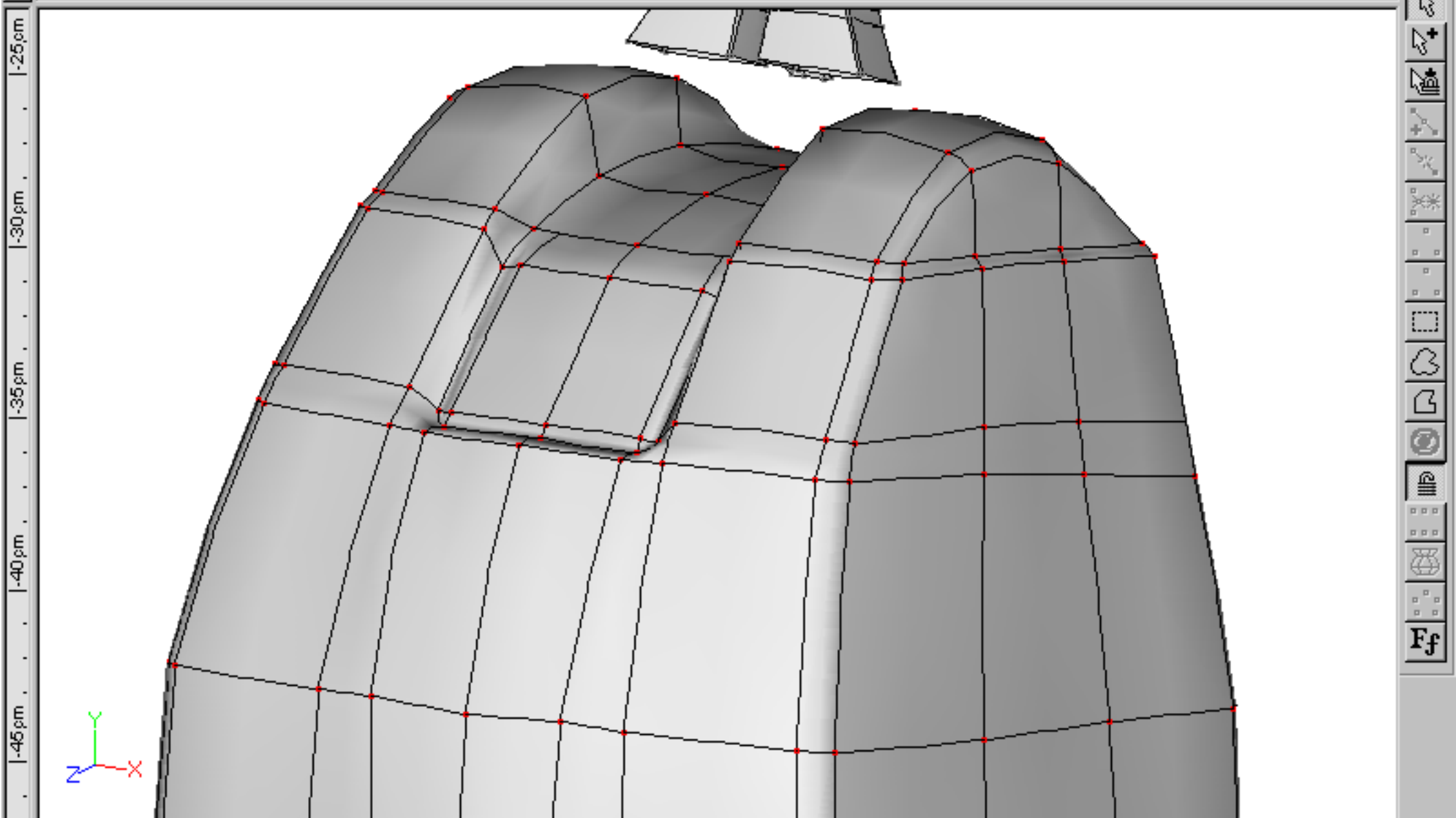








|-15cm | -10cm | -5cm | 0cm | 5cm | 10cm | 15cm | 20cm

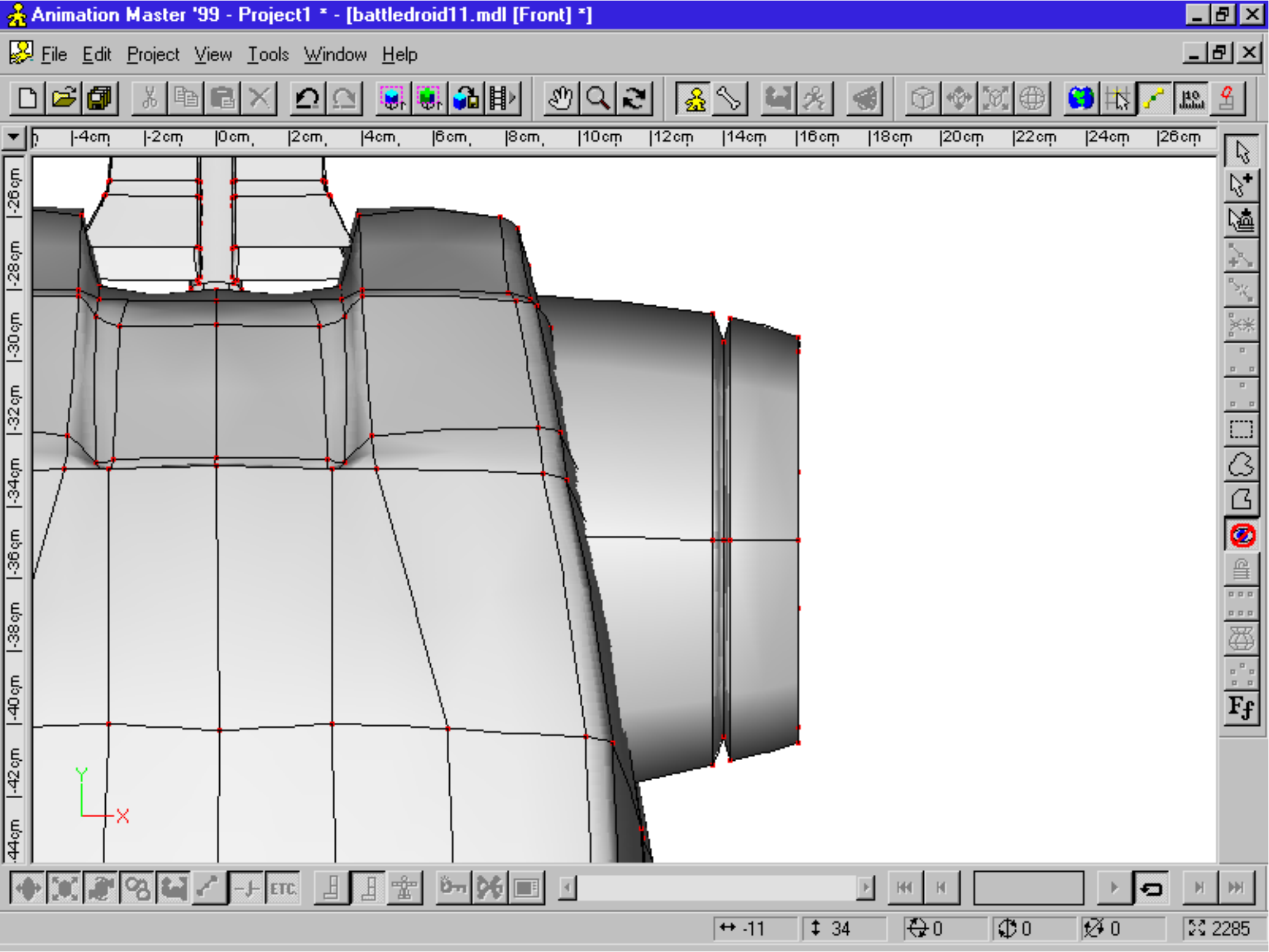


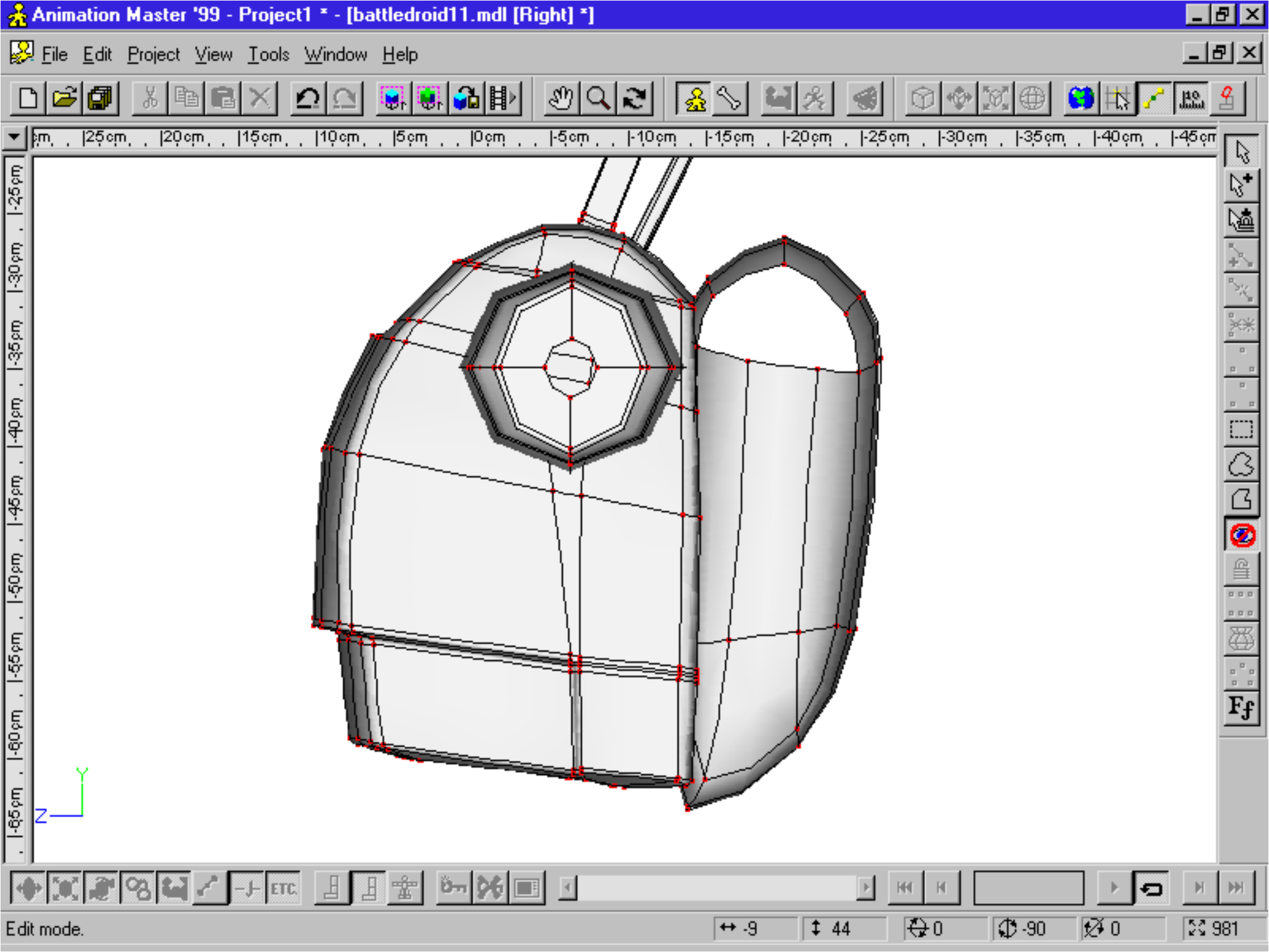


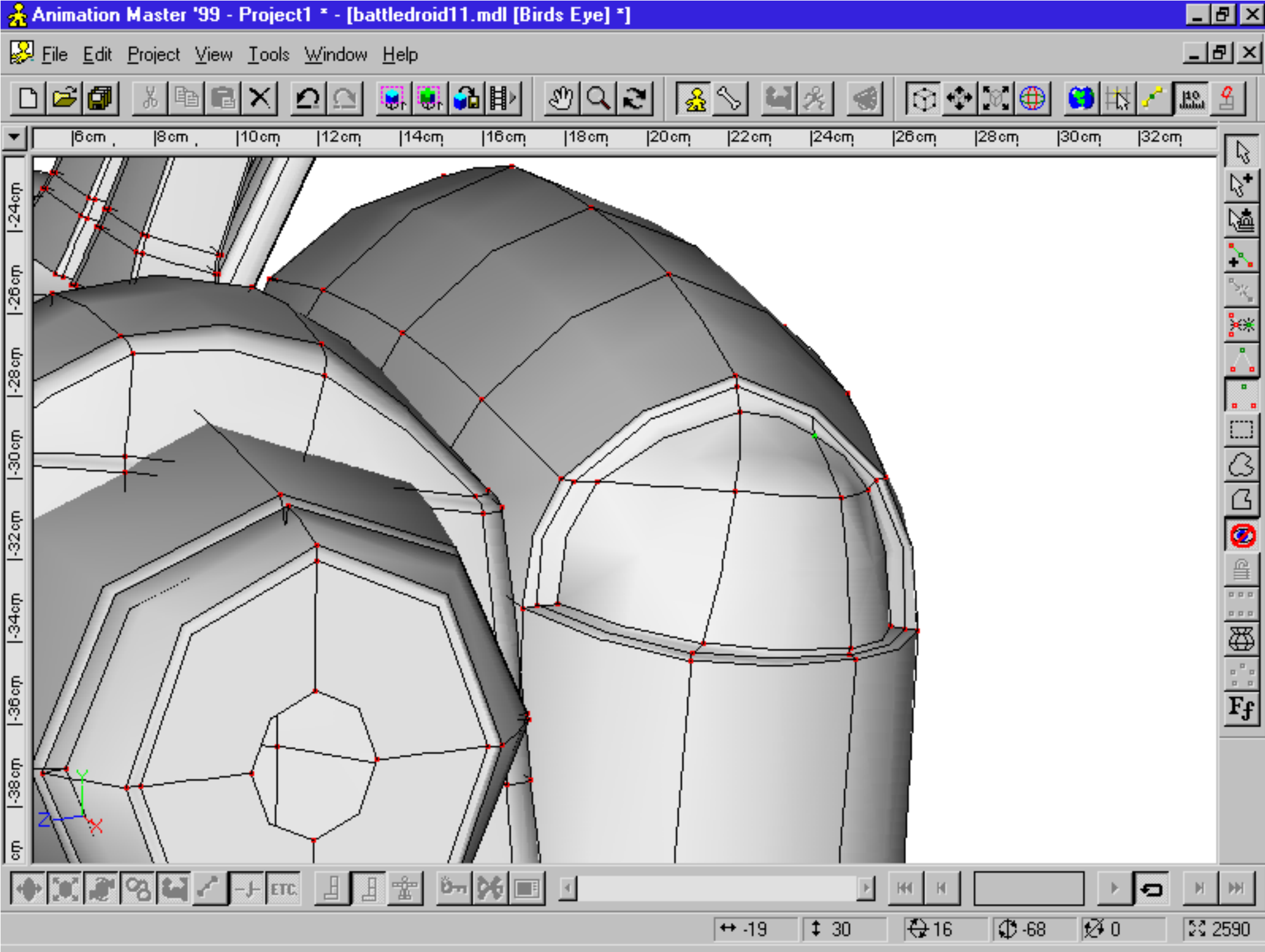
40.

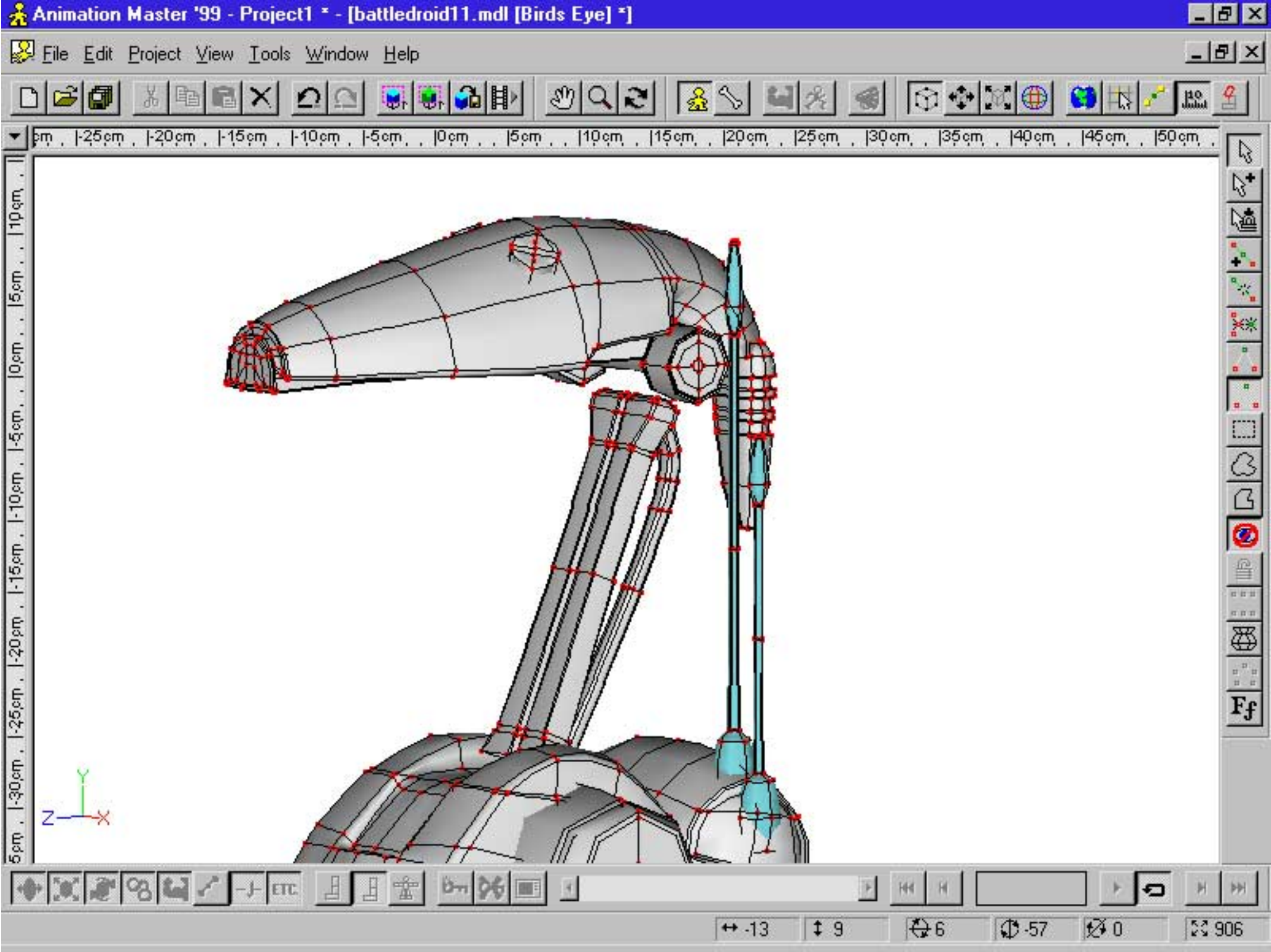


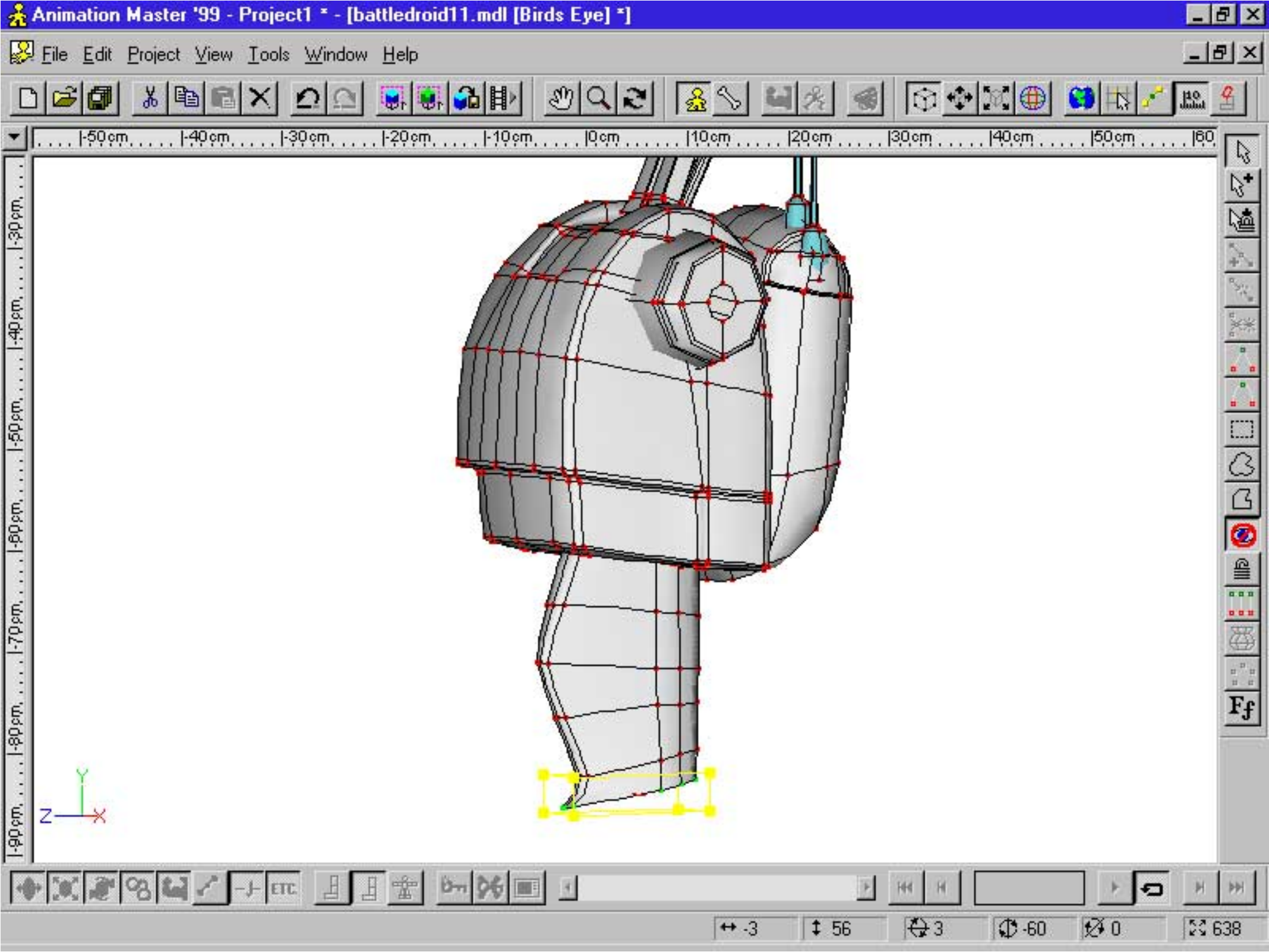
973

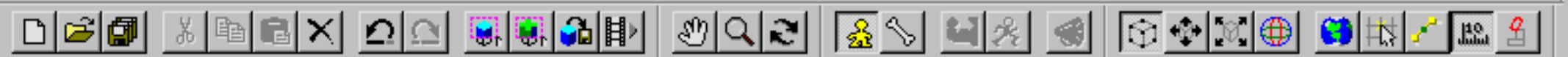




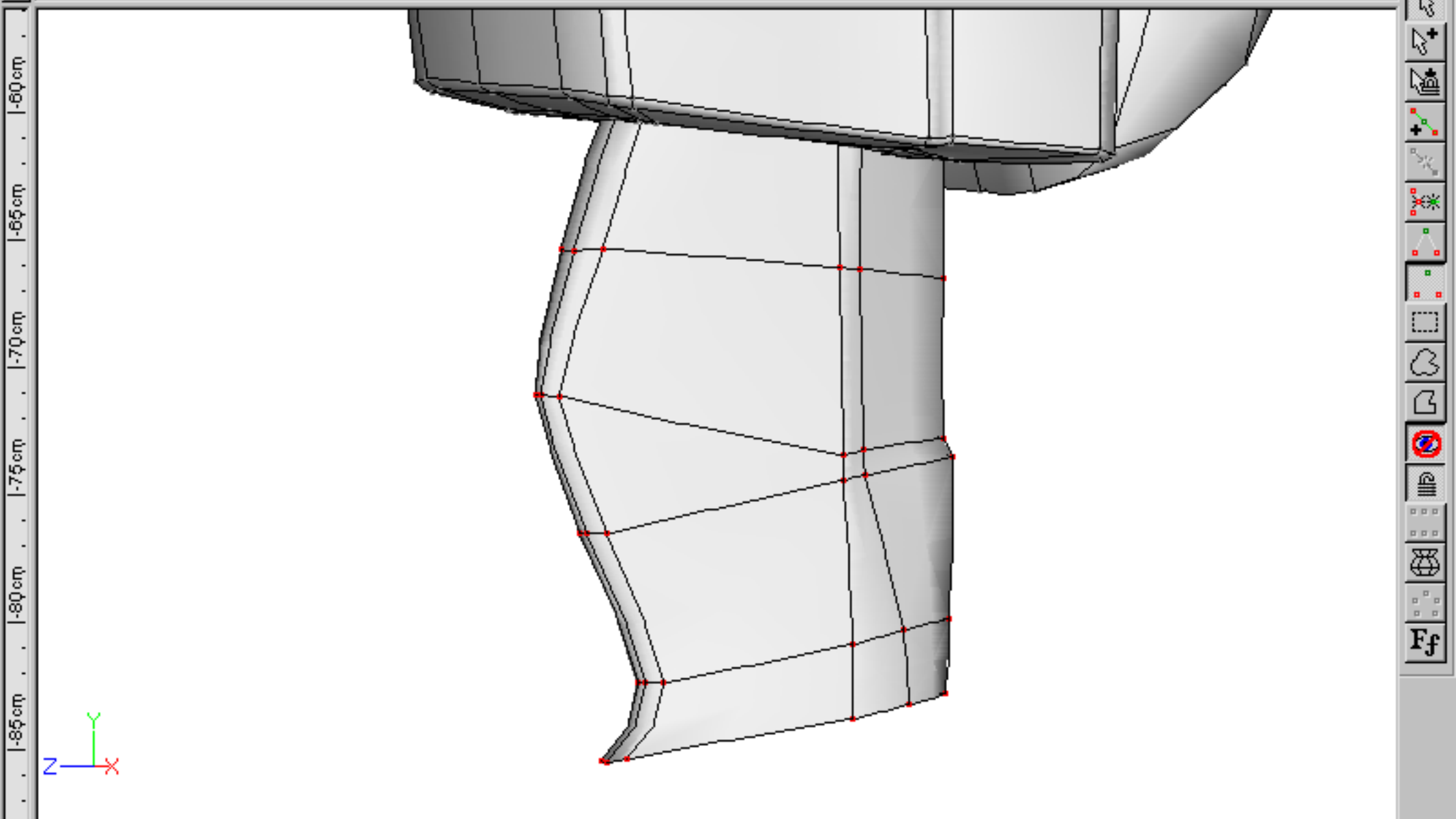








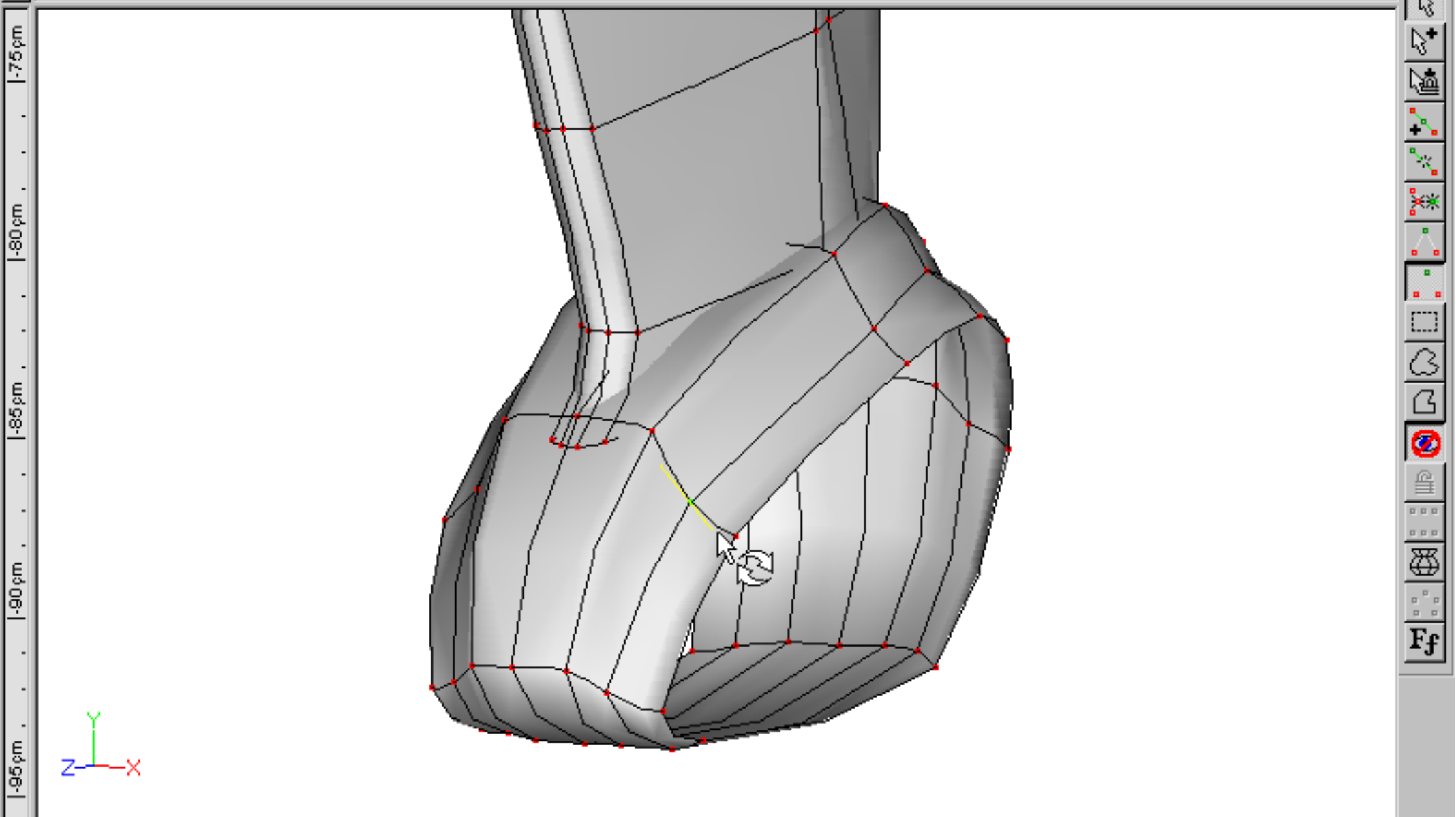
25cm . . | -20cm . . | -15cm . . | -10cm . . | -5cm . . | 0cm . . | 5cm . . | 10cm . . | 15cm . . | 20cm . . | 25cm . .



← -2 ↑ 71 ↺ 2 ↻ -65 ↺ 0 ⏮ 1399

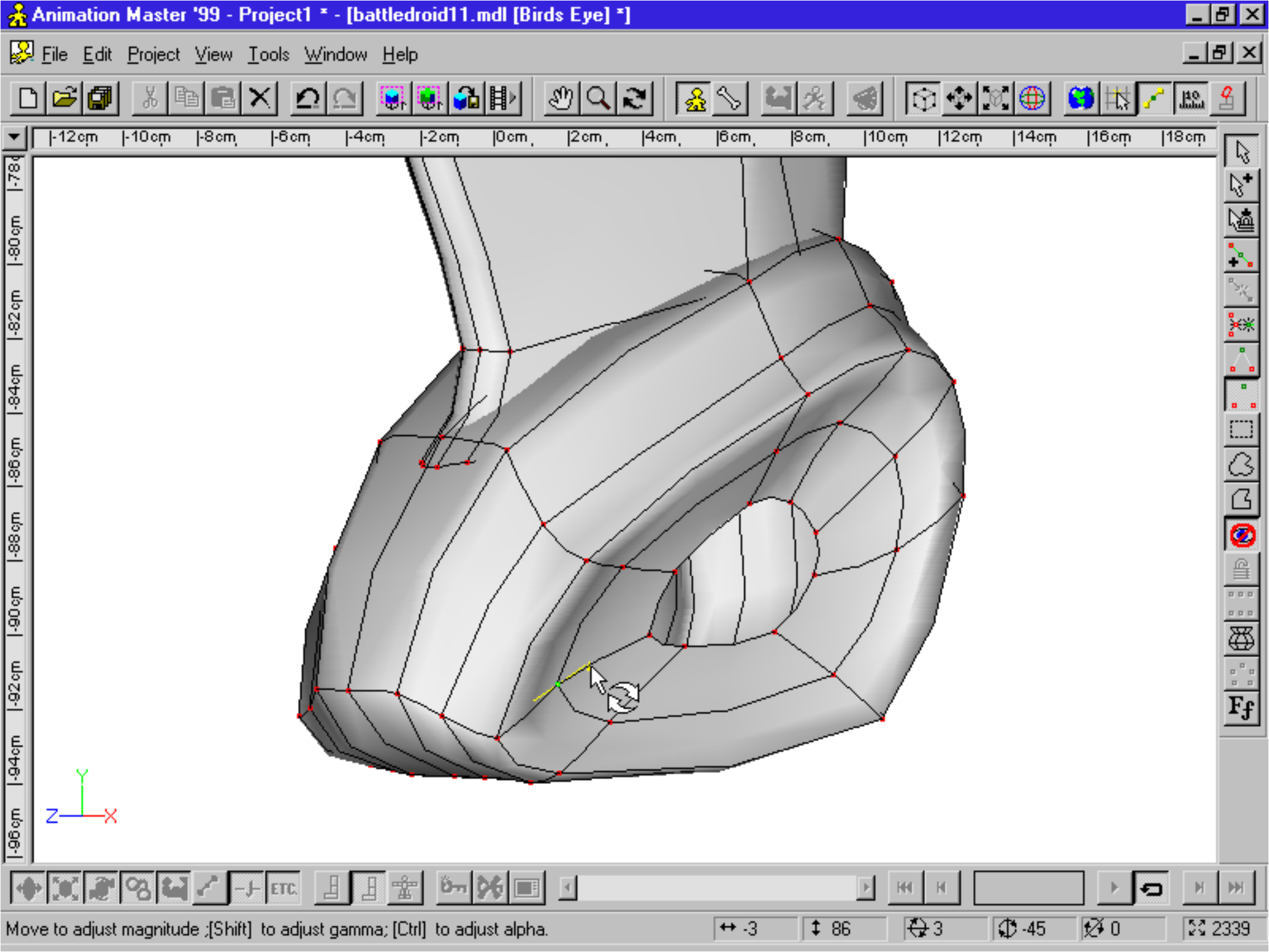


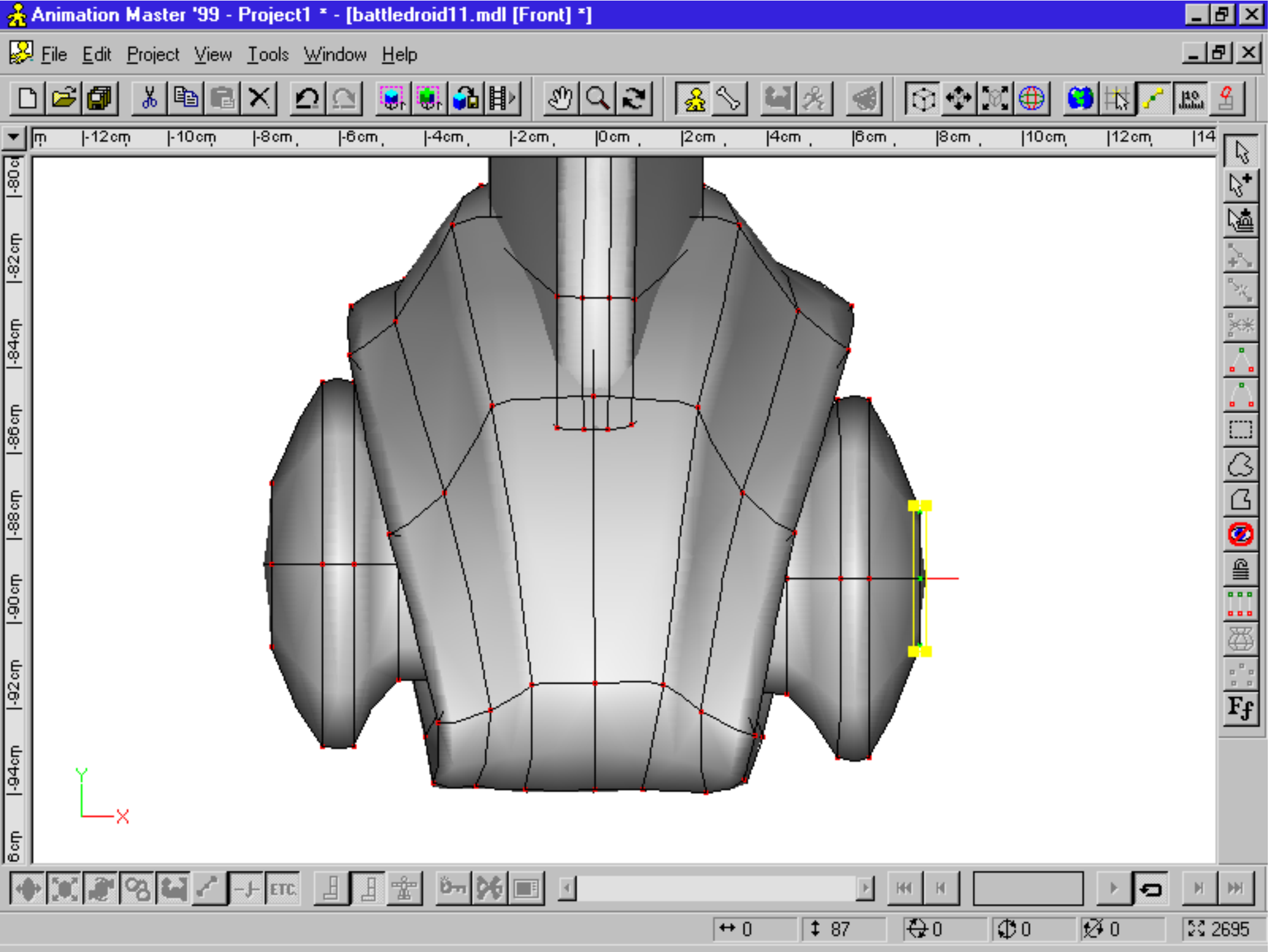
|-15cm . . . |-10cm . . . |-5cm . . . |0cm . . . |5cm . . . |10cm . . . |15cm . . . |20cm



Move to adjust magnitude ;[Shift] to adjust gamma; [Ctrl] to adjust alpha.

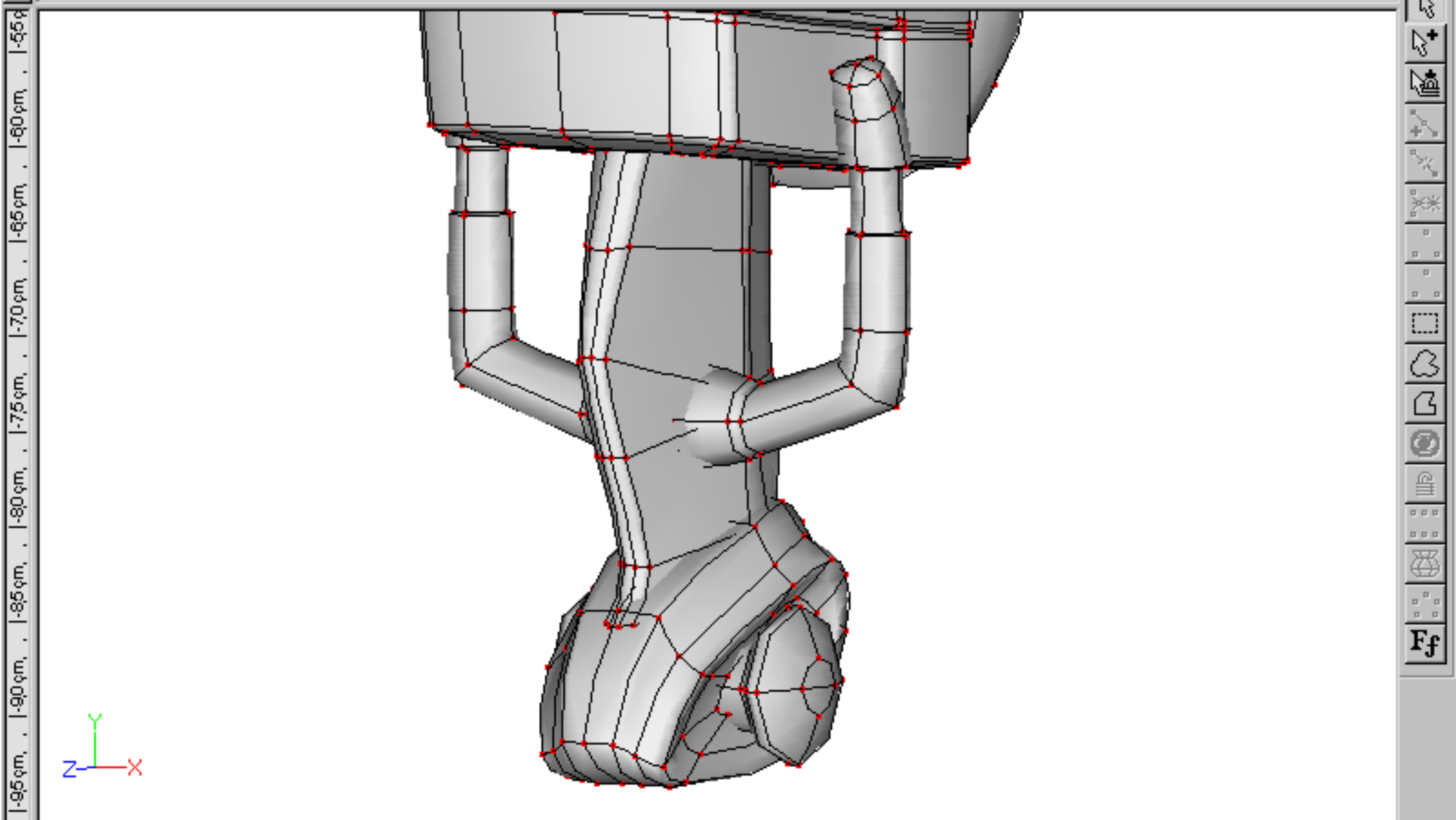
↔ -2 ↑ 84 ↻ 6 ⌛ -31 ⌛ 0 ⌛ 1966

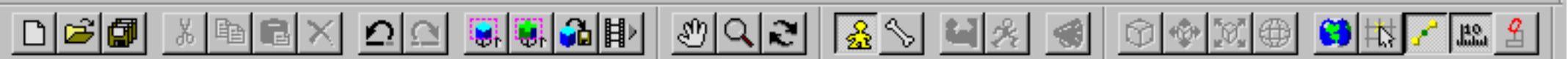




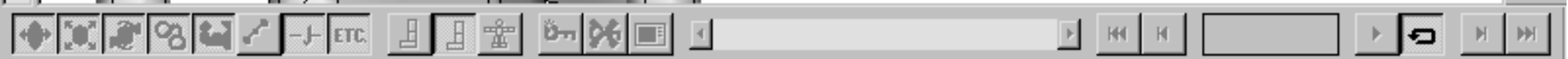
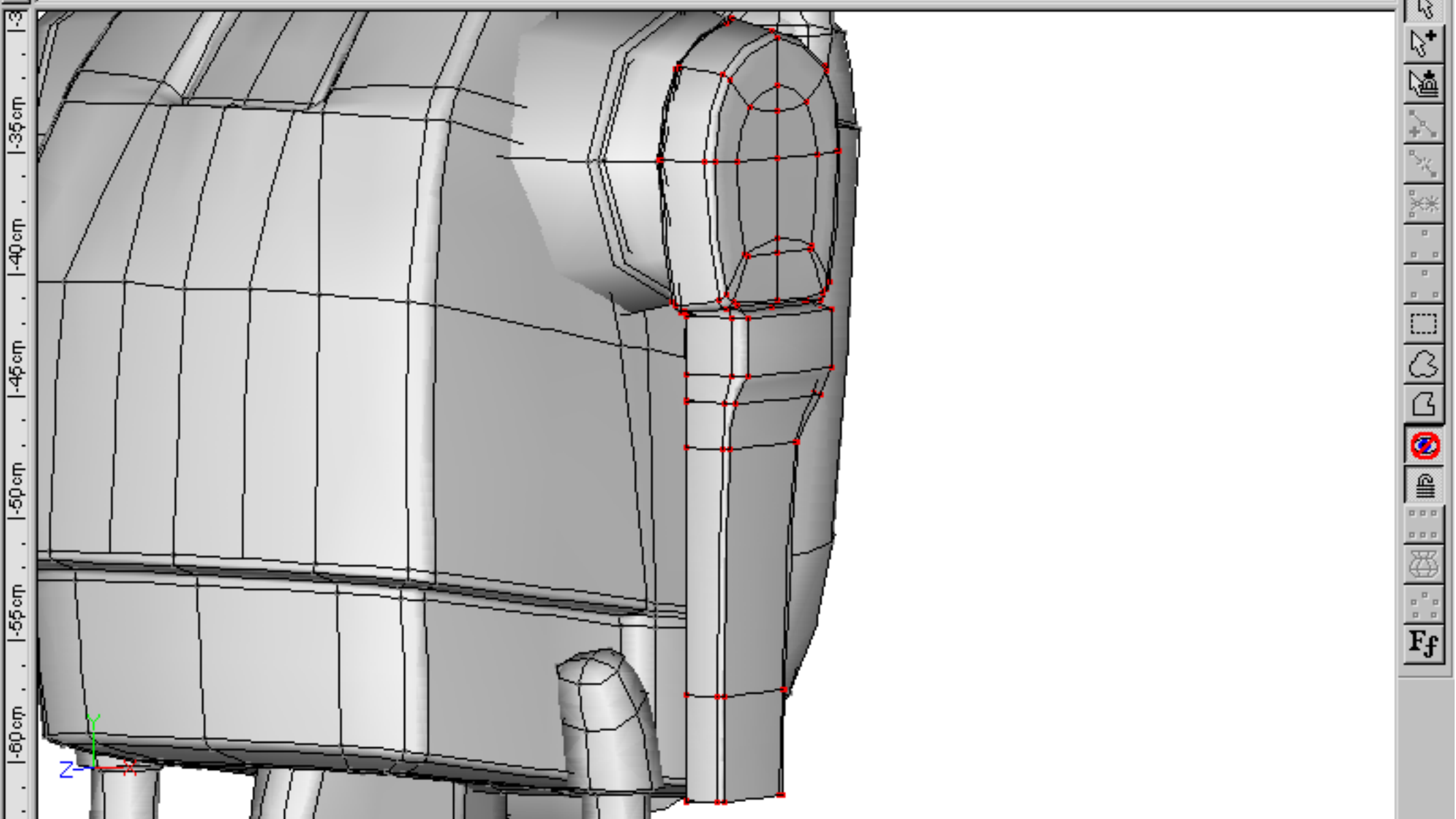


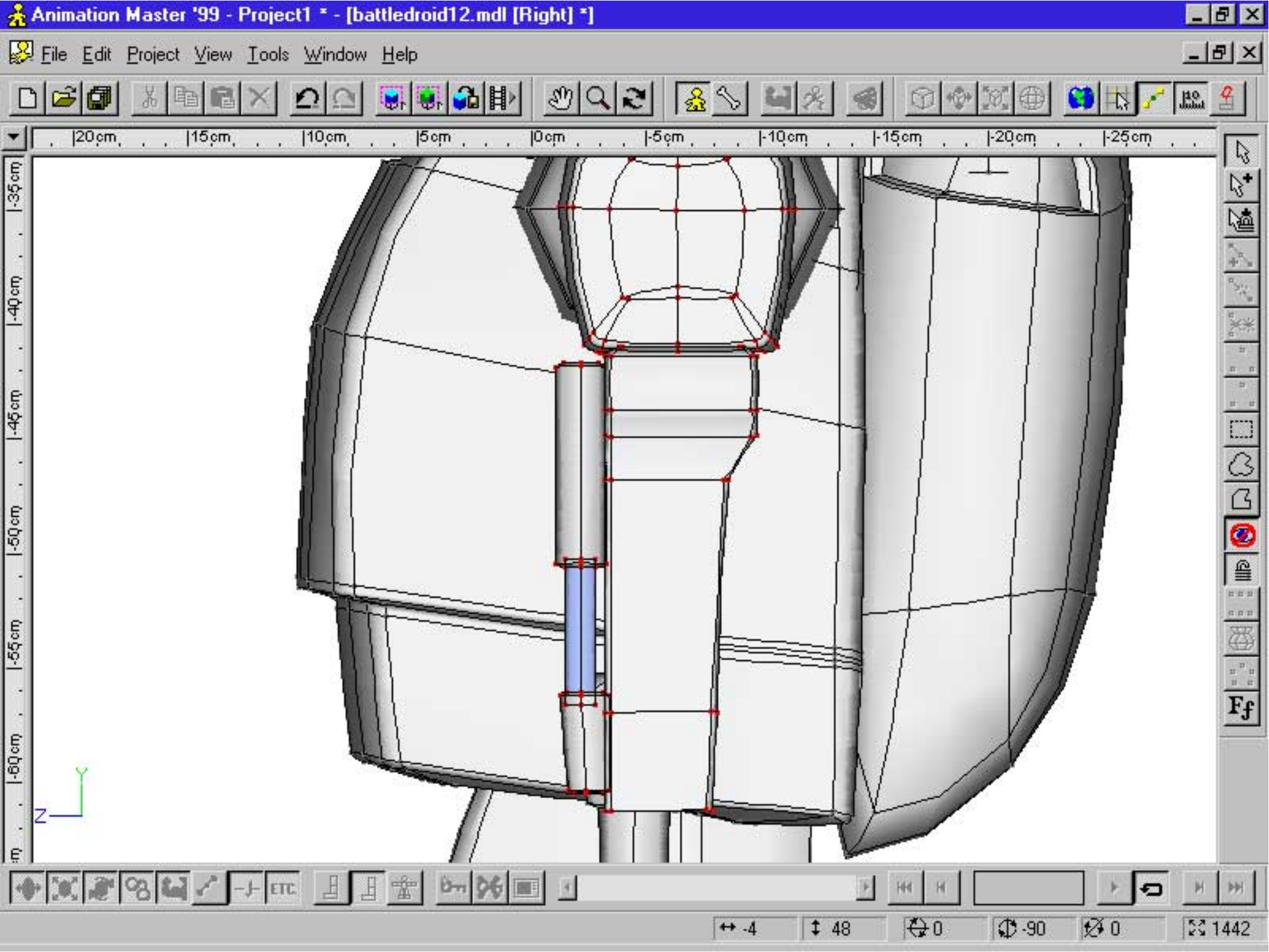
|-30cm, |-25cm, |-20cm, |-15cm, |-10cm, |-5cm, |0cm, |5cm, |10cm, |15cm, |20cm, |25cm, |30cm, |35cm, |

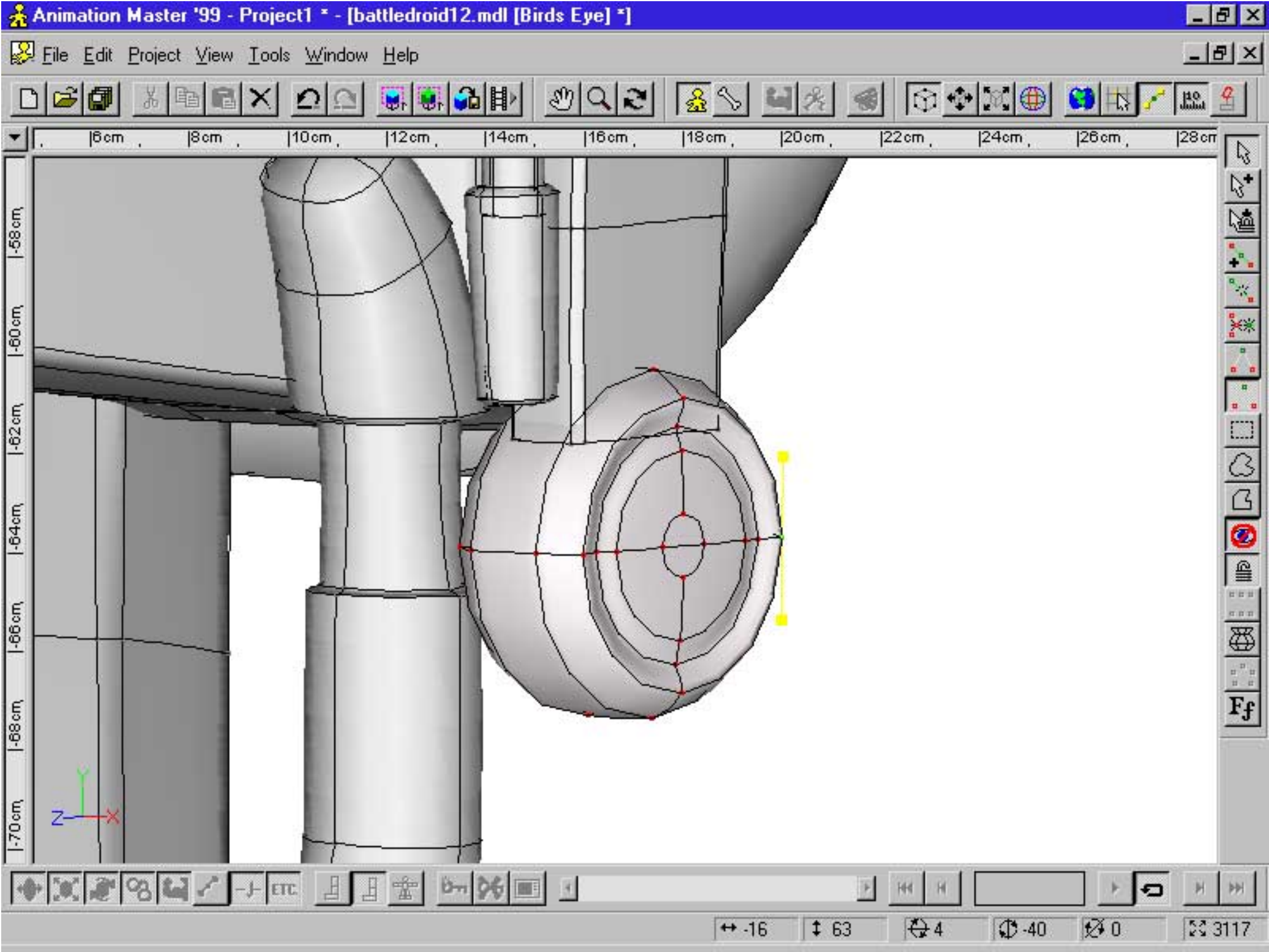


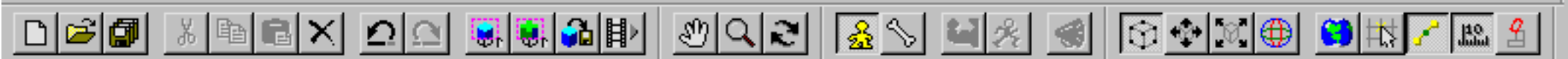


|-10cm . . |-5cm . . |0cm . . |5cm . . |10cm . . |15cm . . |20cm . . |25cm . . |30cm . . |35cm . . |40cm . .

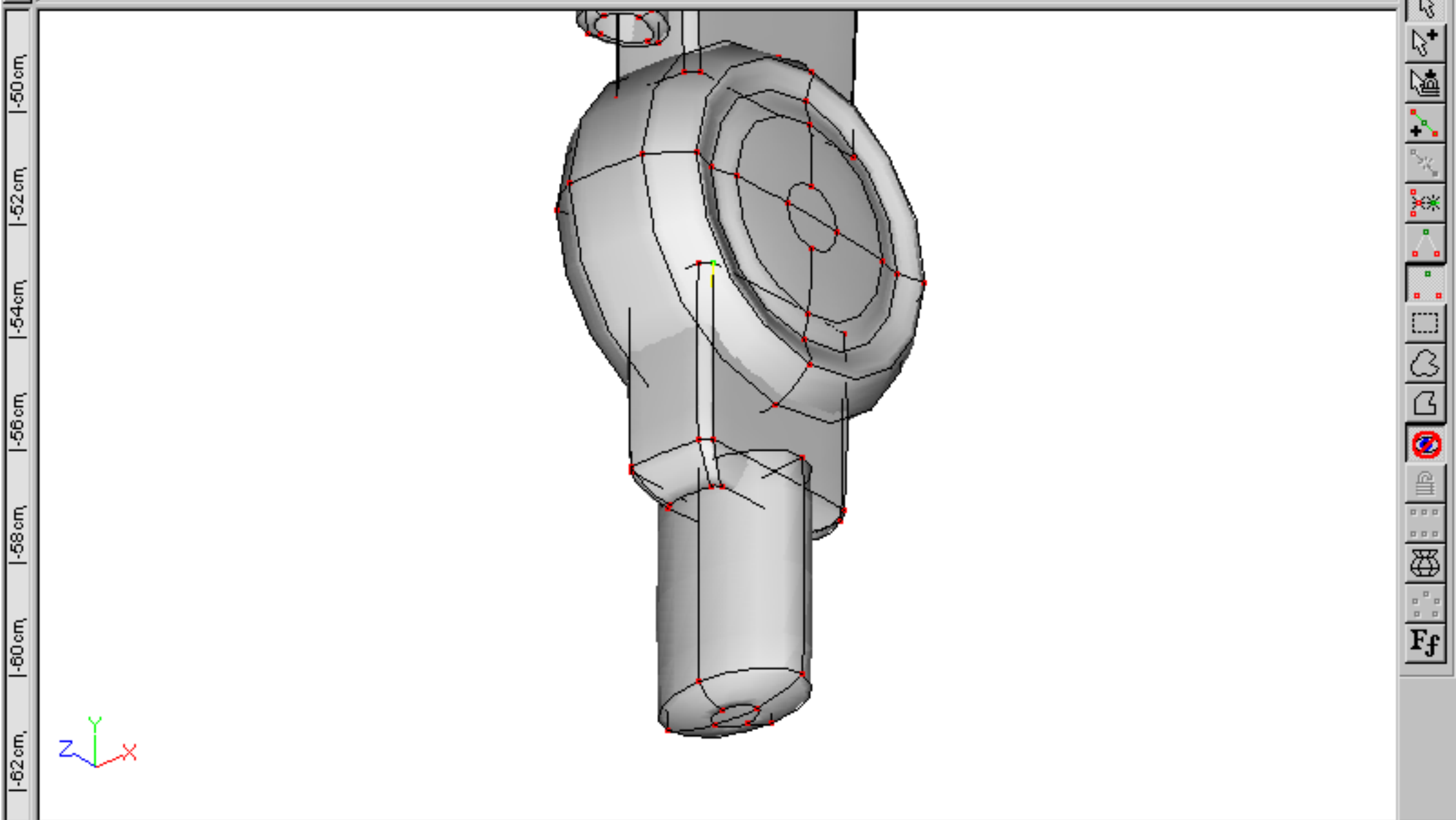




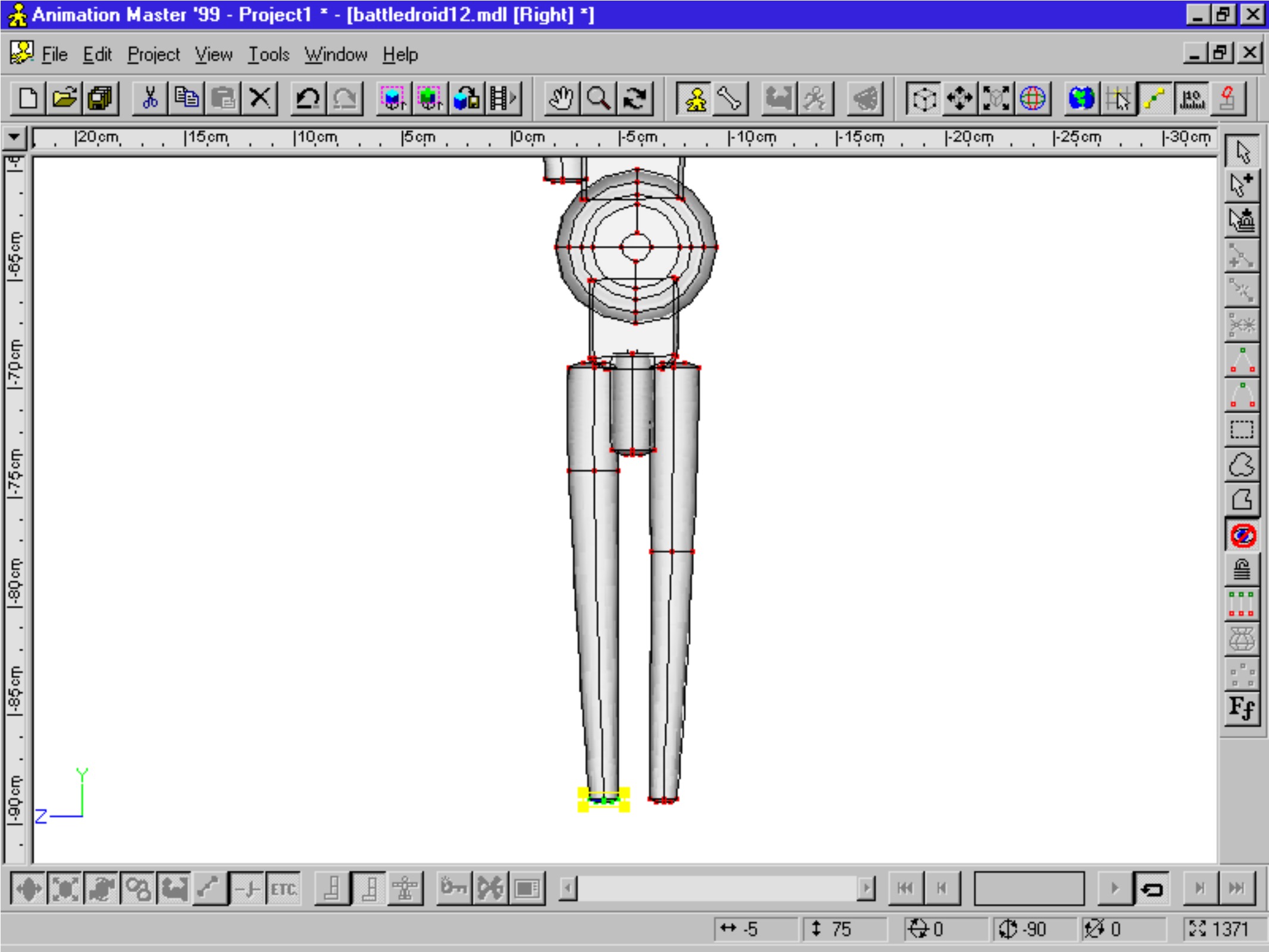


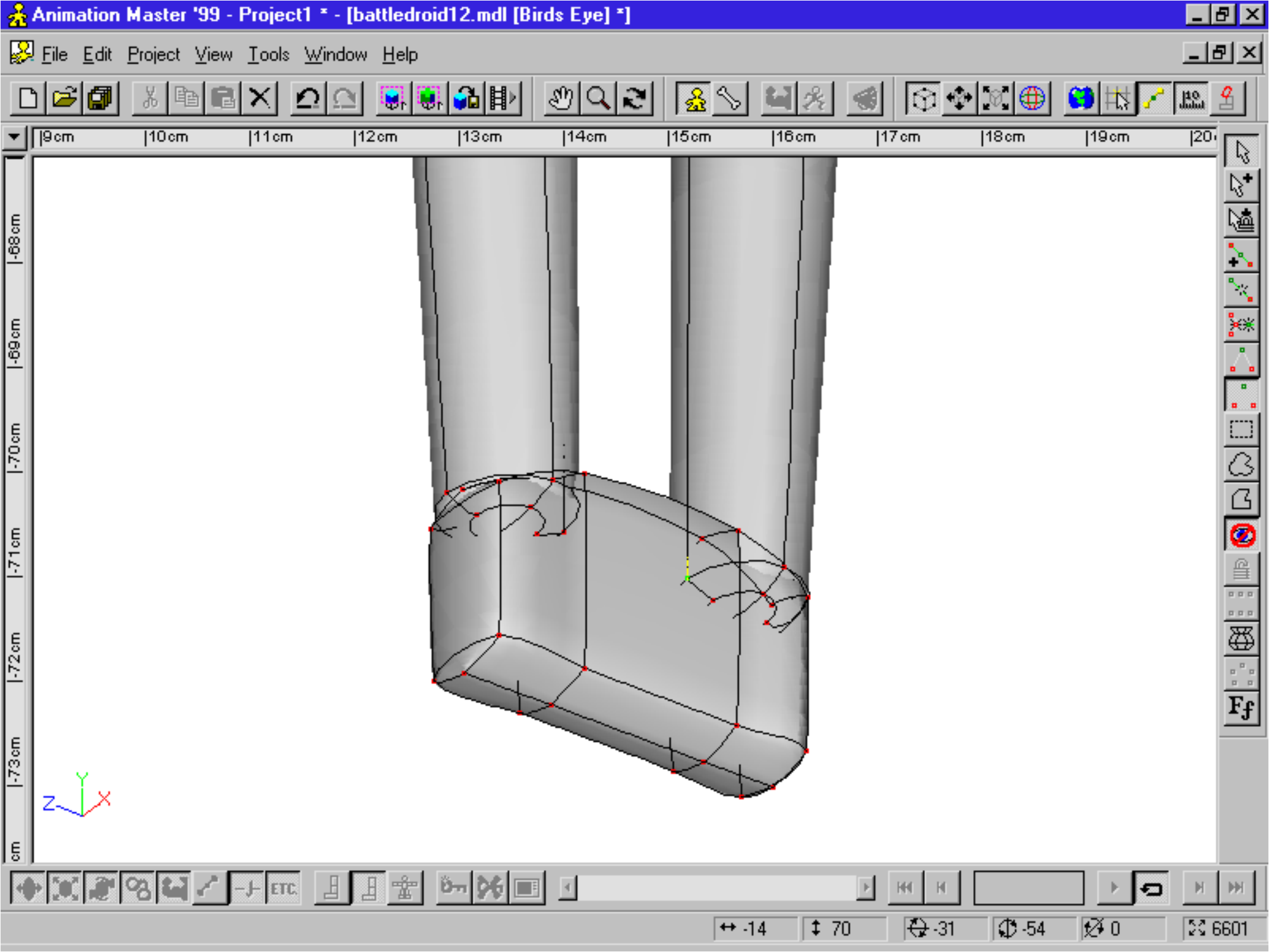


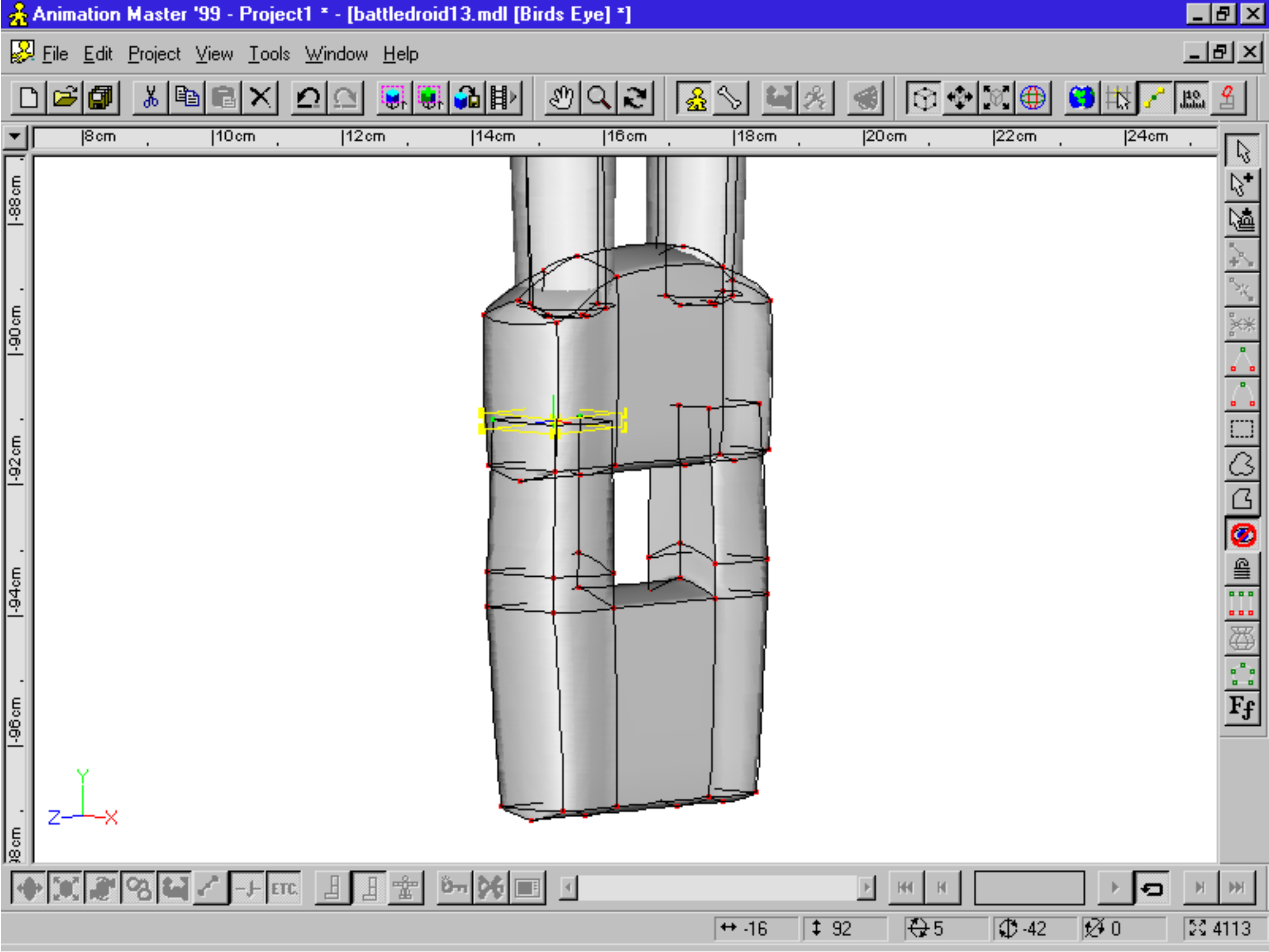
cm , 6cm , 8cm , 10cm , 12cm , 14cm , 16cm , 18cm , 20cm , 22cm , 24cm , 26cm , 28cm

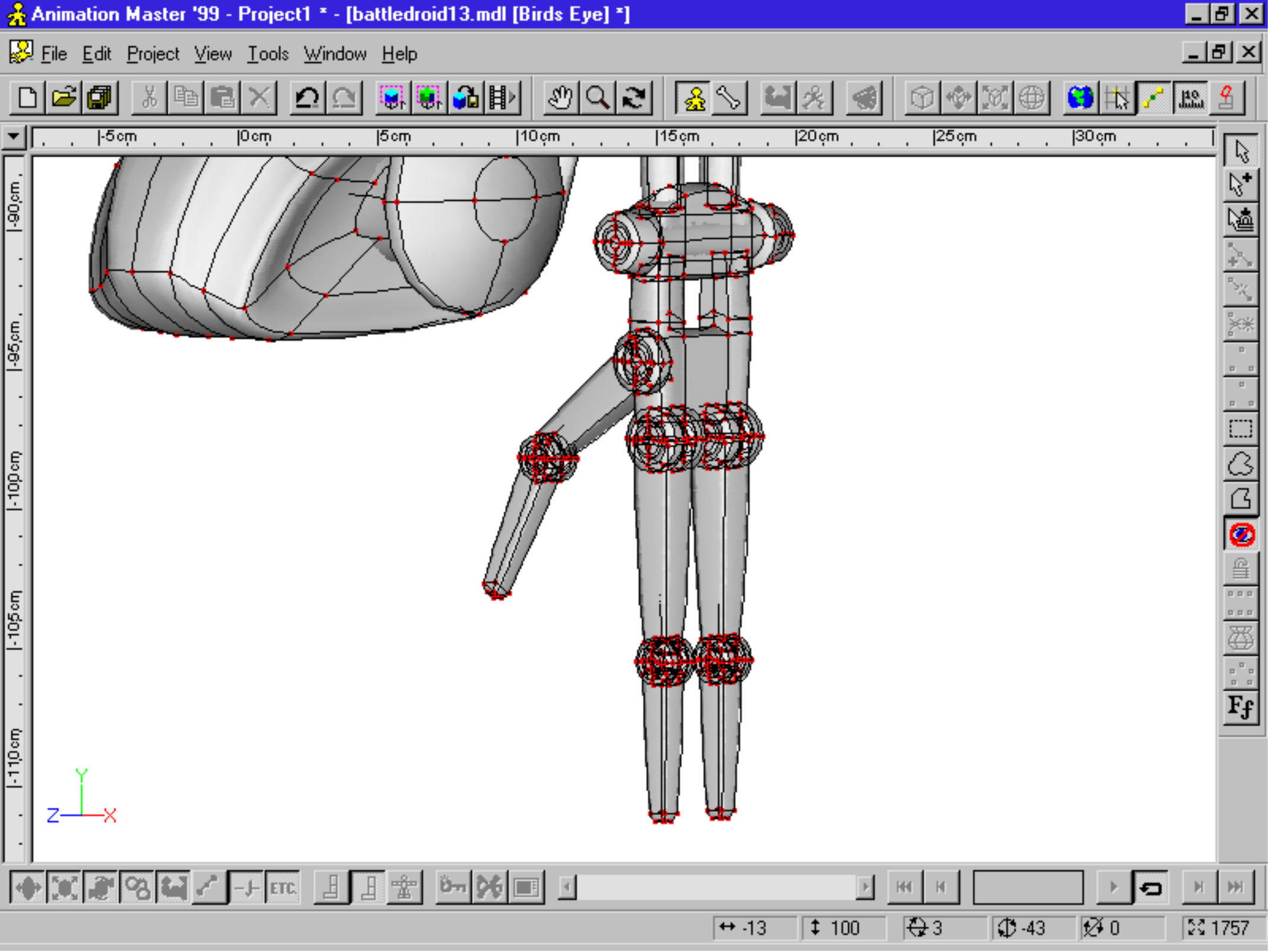


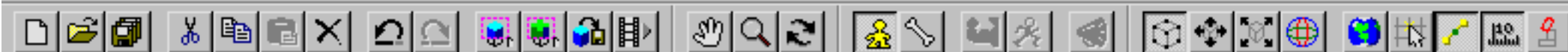
← -16 ↑ 55 ↺ -29 ↻ -40 ↻ 0 ↻ 3102



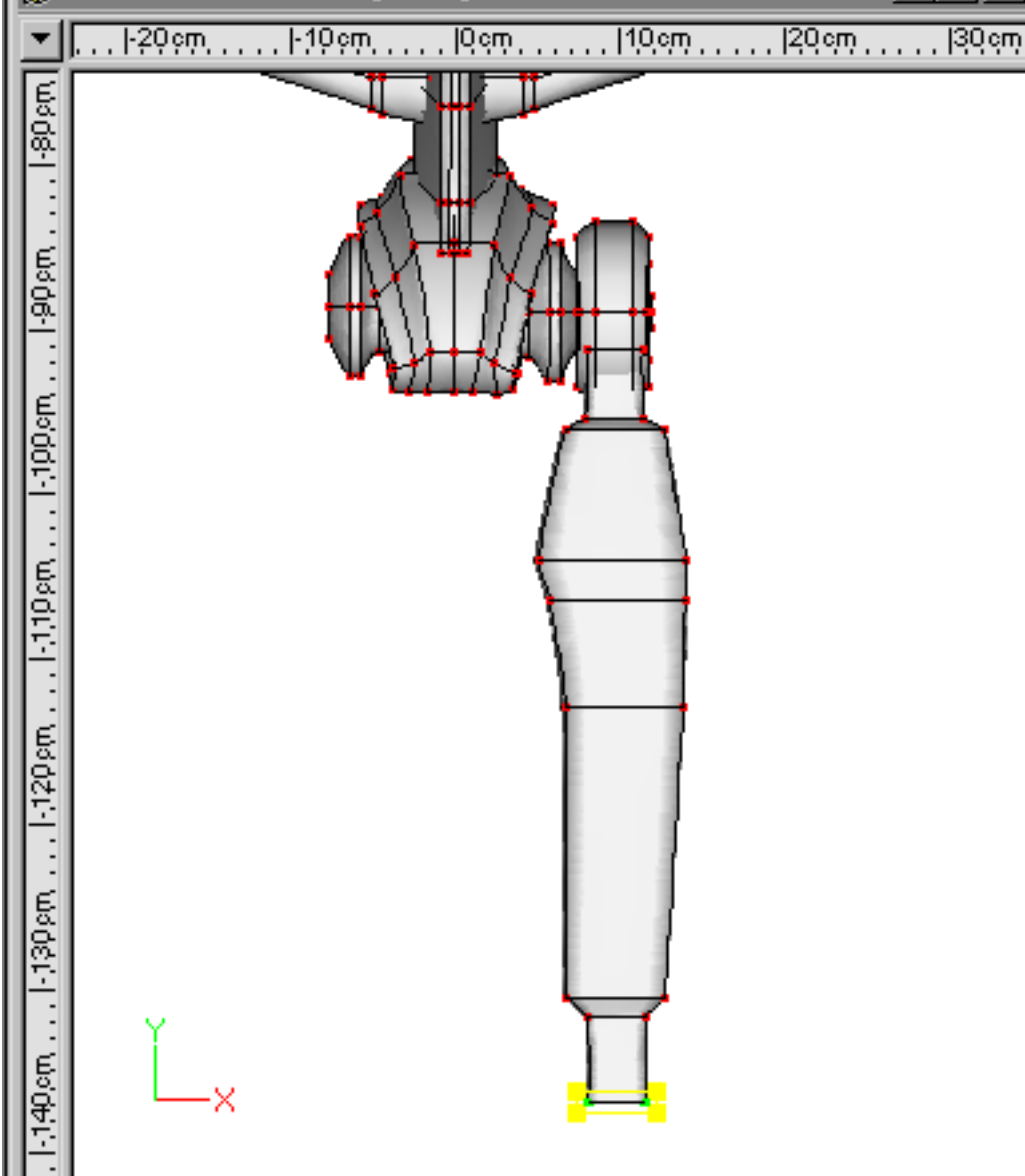




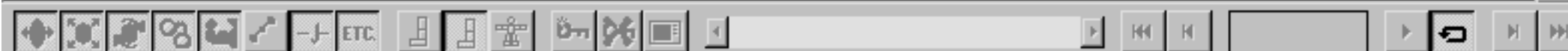
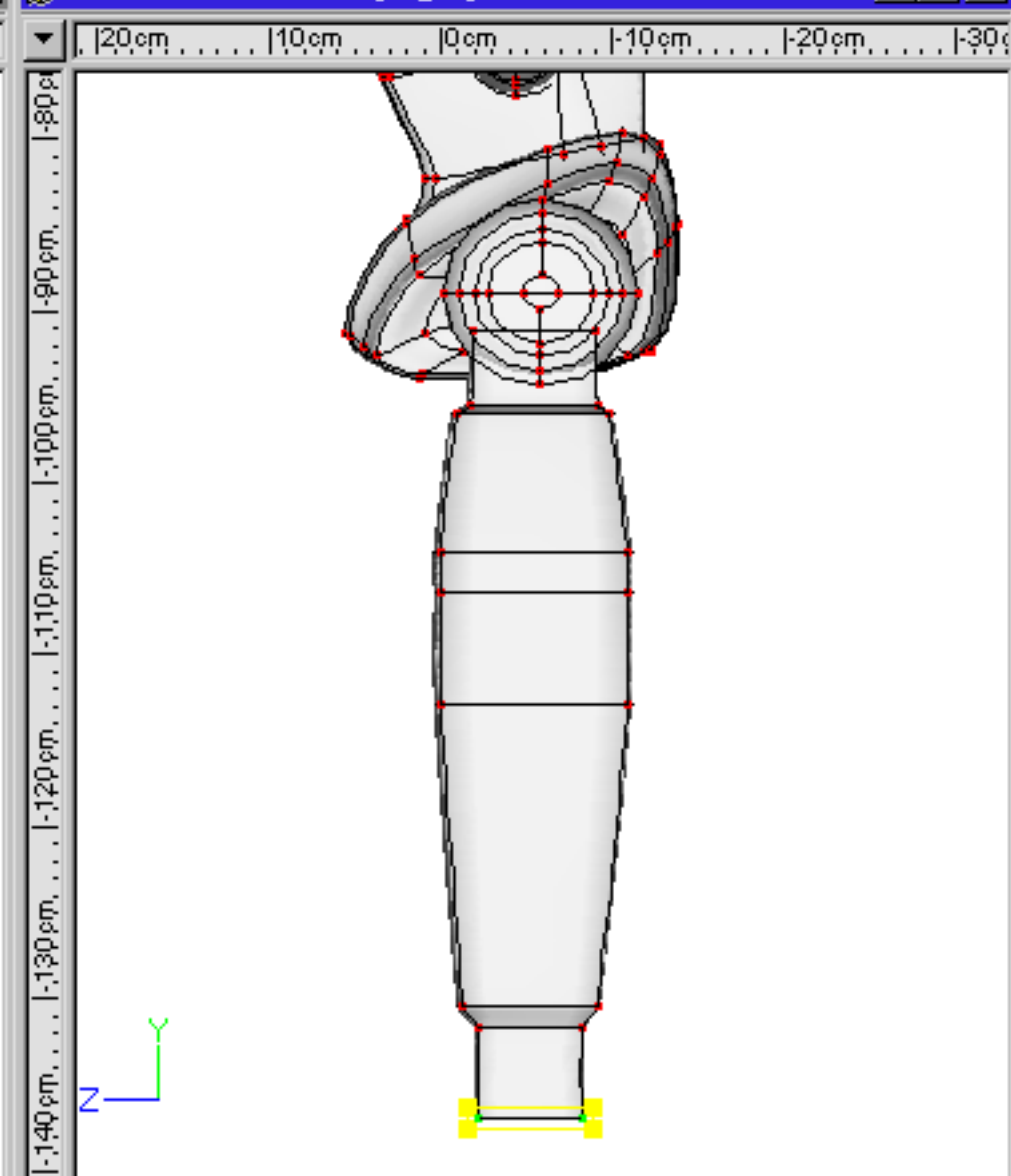


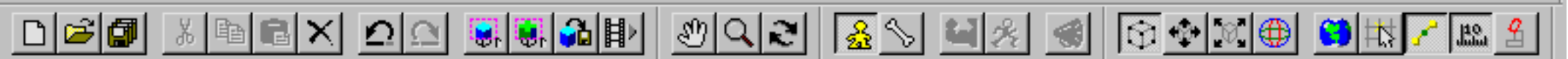


battledroid13.mdl:1 [Front] *

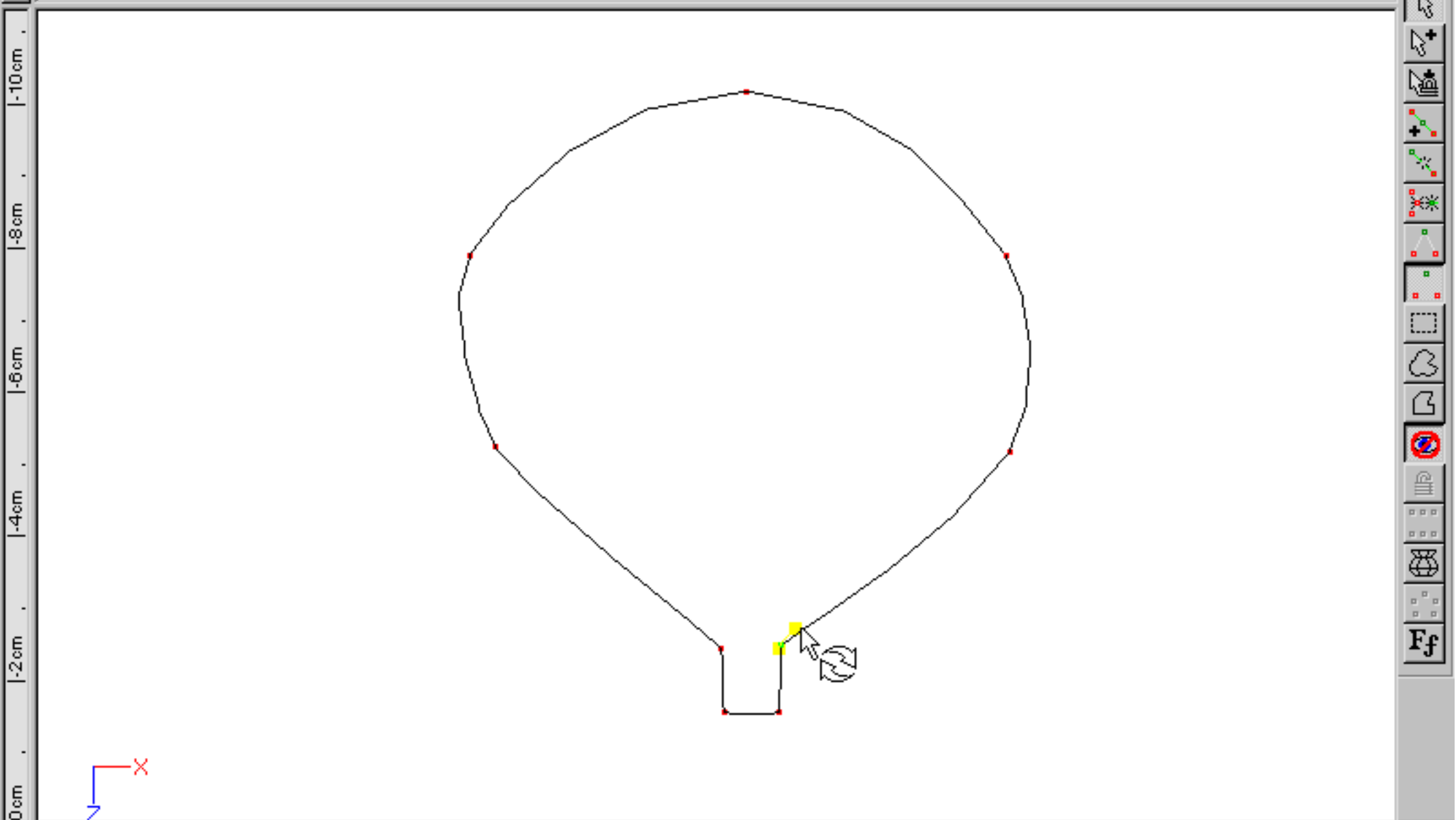


battledroid13.mdl:2 [Right] *



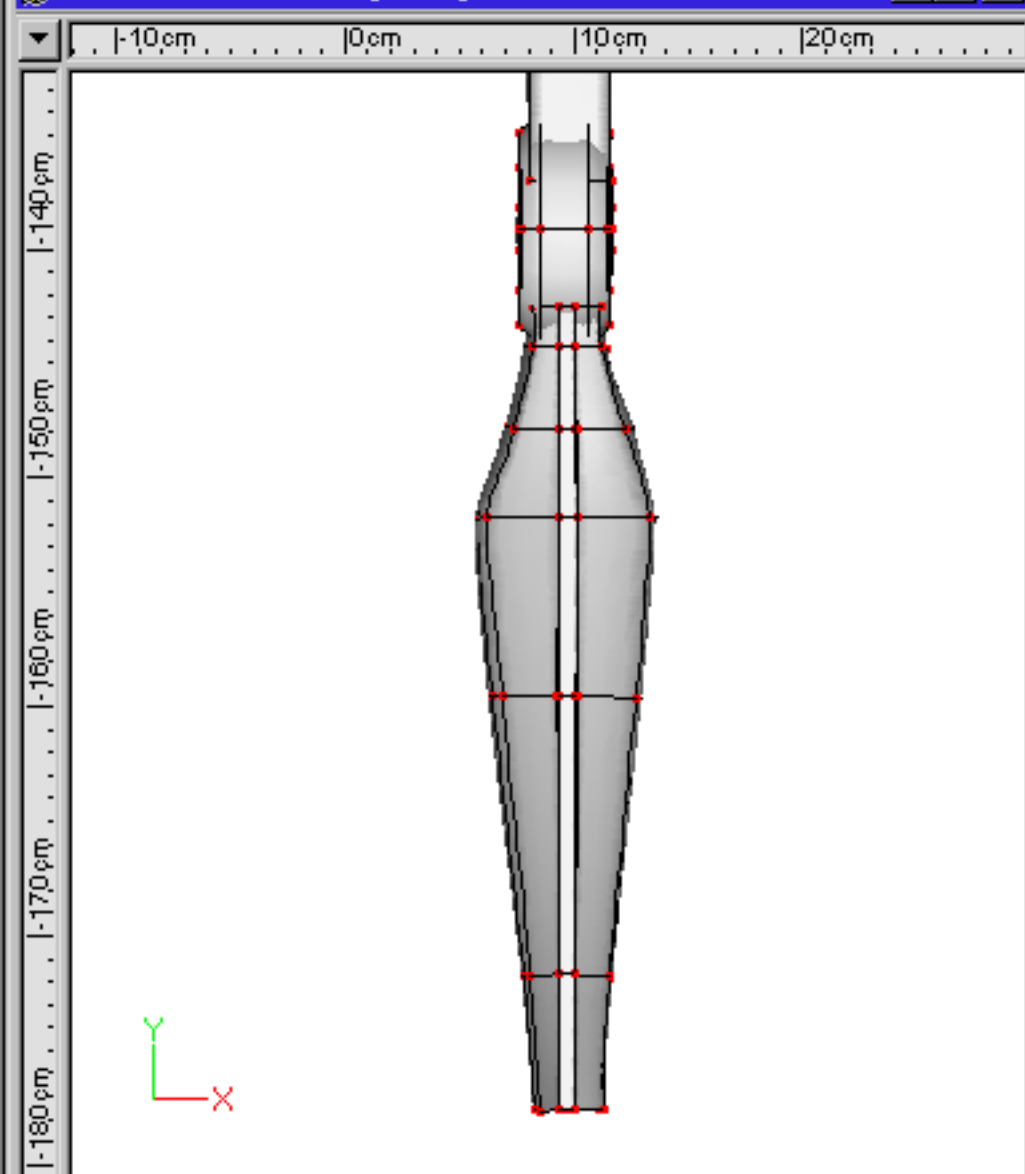


0cm 2cm 4cm 6cm 8cm 10cm 12cm 14cm 16cm 18cm

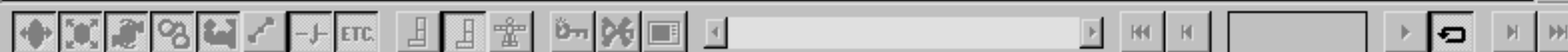
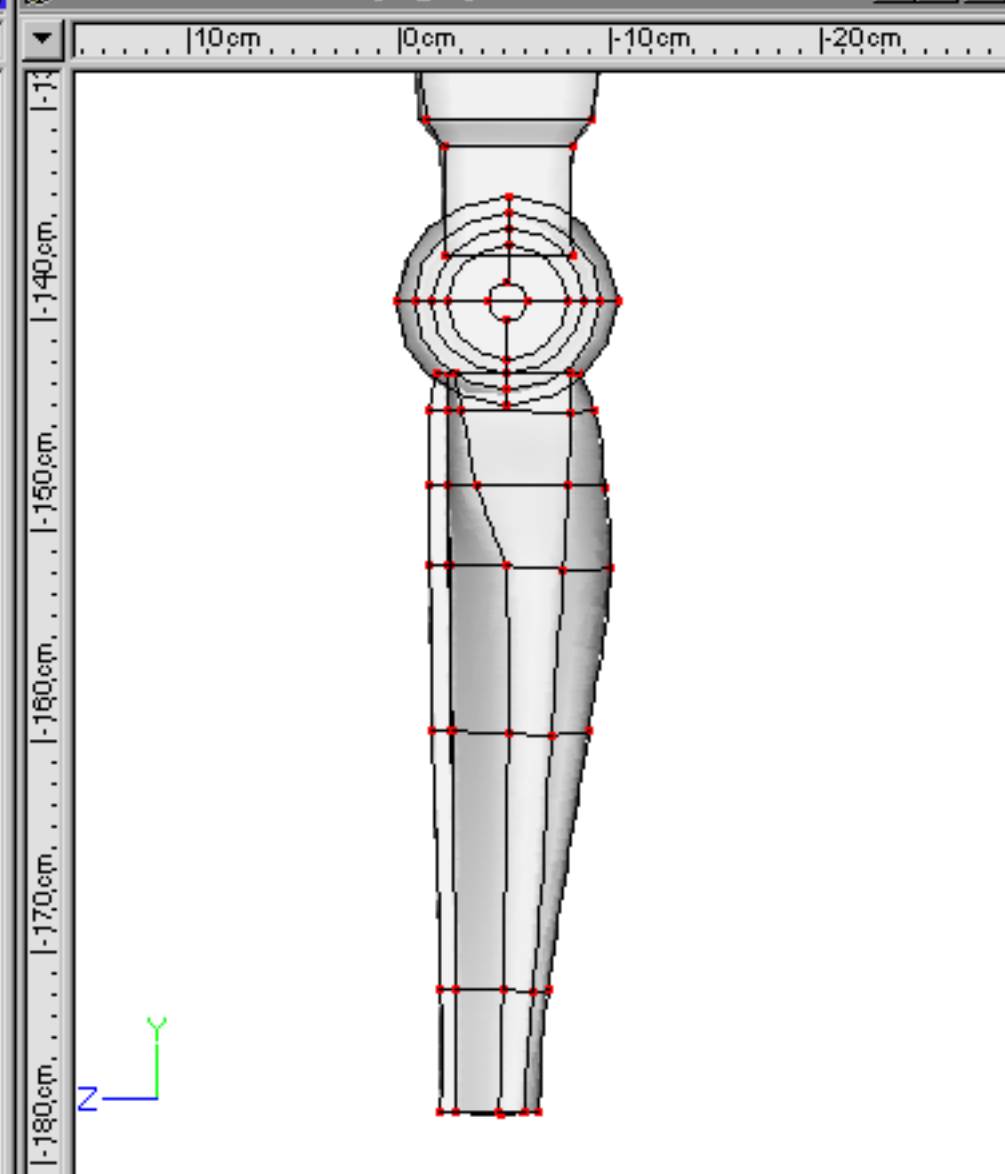


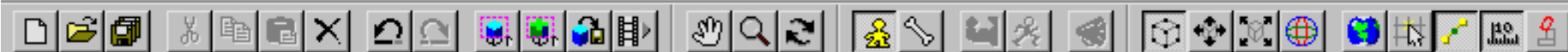


battledroid13.mdl:1 [Front] *

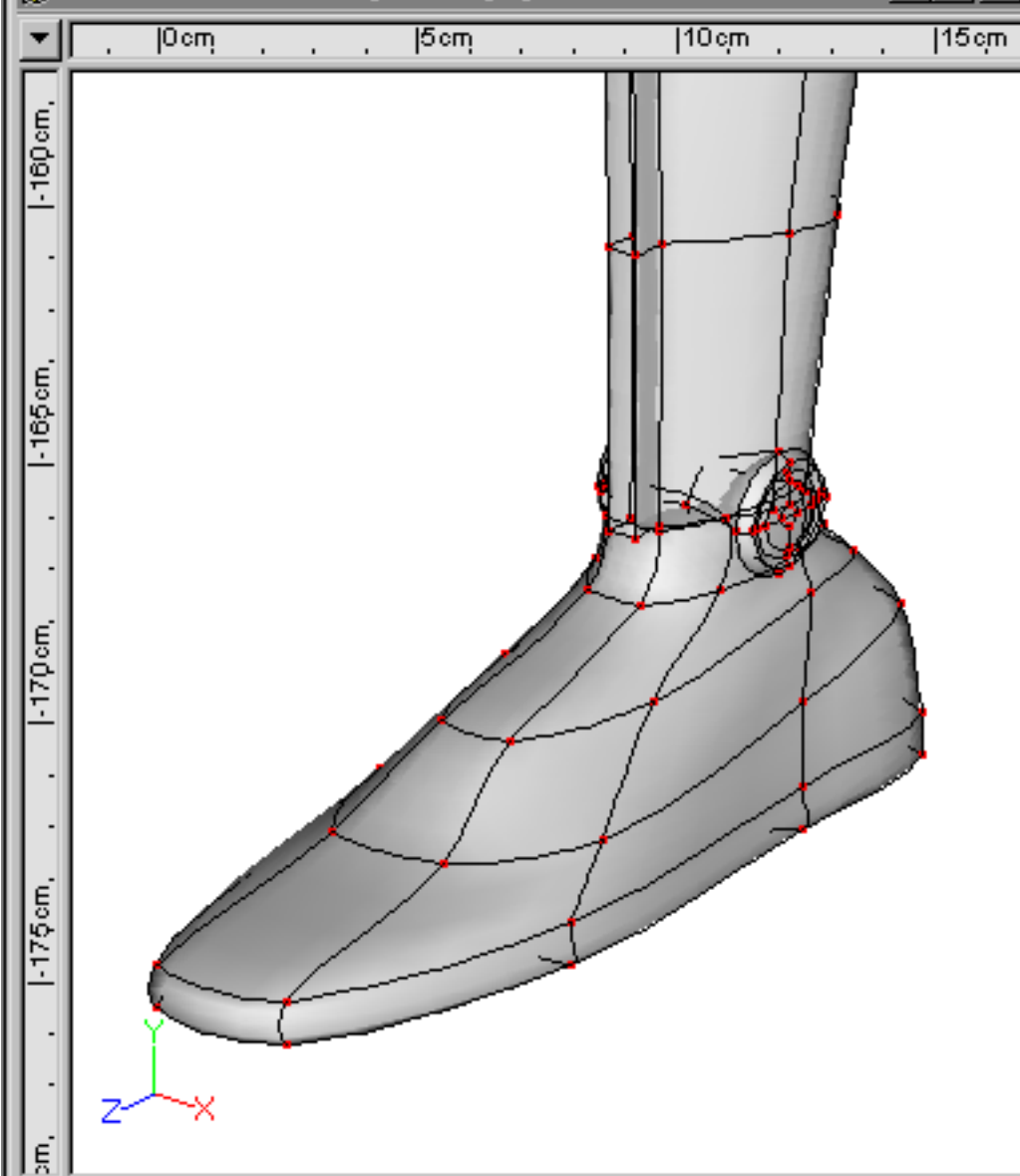


battledroid13.mdl:2 [Right] *





battledroid13.mdl:1 [Birds Eye] *



battledroid13.mdl:2 [Birds Eye] *

