

MacroModel v.1.0



Product Demonstration Script



SETUP

System Configuration

Macintosh II family or Quadra family (accelerated II Ci or better preferred). 8-bit color display card, color monitor, hard disk with 5Mb disk space free, 8Mb RAM minimum (16 Mb RAM preferred)

Applications & Extensions

MacroModel v.1.0 and Scripts folder

QuickDraw (if used w/out System 7)

Files You Need

- "MacroModel Demo" file

System Configuration

- QuickDraw (if used w/out System 7)

MacroModel Configuration

- Set application memory to 10 Mb (if your system will allow it)
- MacroModel Demo file open

Goal

- To build a realistic product prototype based on the "Direction 2000" product concept

Process Steps

- 1.. .Introduction to MacroModel
- 2.. .Setting-up the Body Outline
- 3.. .Building the Screen
- 4.. .Building the Control Panel
- 5.. .Building the Trackball
- 6.. .Building the Product Body
- 7.. .Building the Antenna
- 8.. .Viewing the Model

1. Introduction to MacroModel

Starting MacroModel

- Double-click on "MacroModel Demo" file icon application icon to launch MacroModel.

- Point to the Tool Pallet

- Point to the Work space

- Point to the Tool Pallet

- Toggle on "Show Working Plane" from the Object Menu

- Toggle off "Show Working Plane" from the Object Menu

MacroModel is a spline-based CAD accurate modeling tool that allows users to create a wide variety of three dimensional models useful to multimedia developers, graphic artists, product designers, engineers and any other professional needing powerful 3D modeling.

MacroModel is designed to allow users comfortable with a wide variety of 2D illustration and CAD tools to move their ideas into the third dimension.

When you design in MacroModel, you design in one window. This window looks into a 3D world that has x,y & z axis'.

All of MacroModel's object's are built from simple or complex 2D shapes. 2D shapes are built from a wide variety of common tools that you are probably already used to using

To draw these objects we need to have a surface, like a piece of paper for example. MacroModel draws and manipulates all 2D and 3D objects on, across and relative to the "Working Plane"

The Working Plane is in itself an object that can be numerically or interactively manipulated and moved within the MacroModel world.

2. Build the Body Outline

Create some "Construction Geometry"

- Show Construction Object tool group from the Tool Pallet



Construction

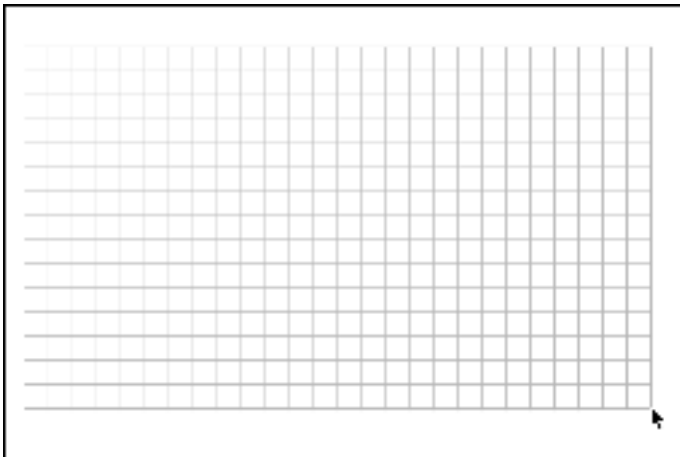
Grid

- Select the Construction Grid from the Construction tool group
- Set the draw center/corner-toggle to corner



Corner Toggle

- Draw a Construction Grid filling the workspace



Before we start to draw the body outline of the Direction 2000 prototype, let's lay out some "Construction Geometry" that we can use to measure and snap geometry to. Construction objects can come in a variety of types including Lines, Grids, Axis' and Points.

For our purposes we will use the Construction Grid

...and we will draw this object from the corner

Now we will lay out a grid across the workspace draw on the current working plane. This grid has a 1/4" grid, which is MacroModel's default measurement. The grid is changeable, which is a feature we will use later.

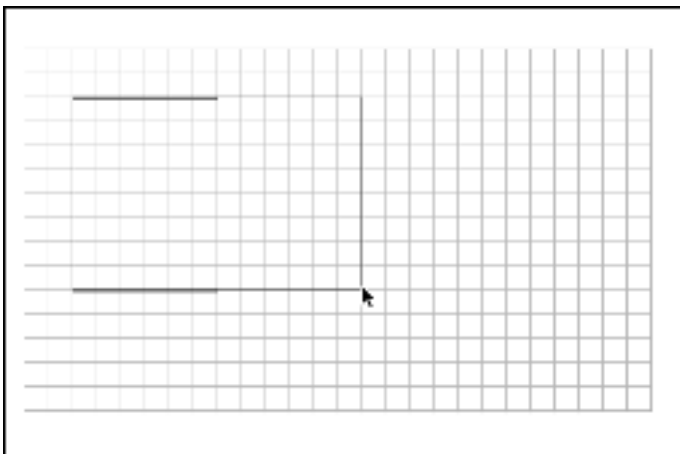
*Remember Construction Grids are NOT substitutes for the Working Plane, although you still can "snap" points to Construction Grids and draw along grids that are not aligned with the Working Plane.

Create some Build the body outline



Rectangle

- Select the Rectangle tool and, starting a .5" in and down from the top left corner of the Construction Grid, draw a rectangle measuring W: 3" x H: 2"



To build the body outline of the product we will start by using simple rectangles to mass-out the shape.

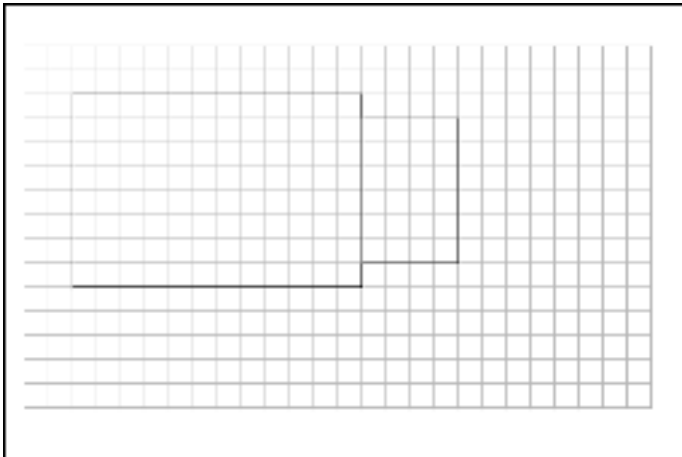
The first rectangle will represent the major portion of the product that houses the Screen and Control Panel.

*Watch the scrolling numbers to measure



Rectangle

- Select the rectangle tool and starting .25" below the right top corner of the first rectangle draw another measuring W: 1" x H: 1.5"



The second rectangle represents the minor portion of the product that houses the Trackball.

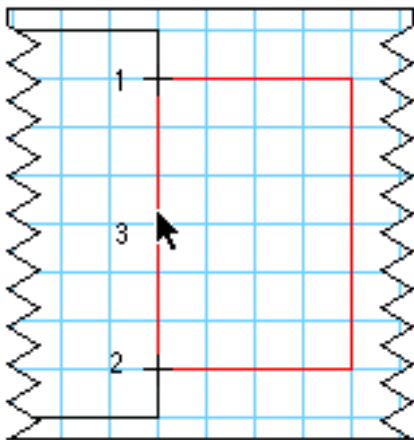
- Select Geometry Modifier tool group and select the Cut tool and cut the lines that the two objects share out (this needs to be done twice: once

for each object).



Cut

To do this click on each end of the line segment and then click the segment itself. Repeat this operation to remove the second piece of geometry.



To make this one continuous 2D object we must cut portions of these two separate rectangles out so that they can be subsequently joined together.

- Marquis select the two rectangles and select "Join" from the Object menu.

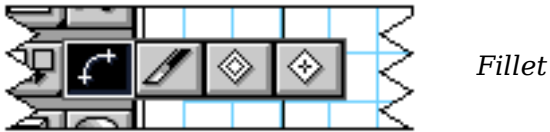
- Click on the line with the cursor.

To cut parts of a 2D object apart simply designate the segment by clicking on each side of the line segment that you want to remove. Notice that the arrow turns into a crosshair when the cursor passes over a line or point. That means that MacroModel is "snapping" to a piece of geometry. After selecting the extent of the piece to be removed, click on the segment itself and it will be cut out. Now do this again because, afterall, there are two pieces of geometry on top of each other.

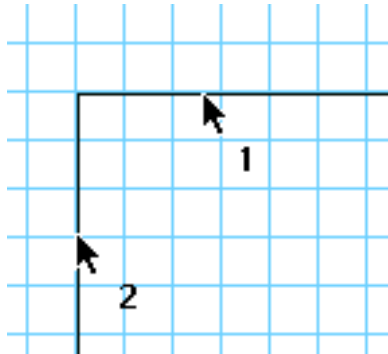
To "Join" these two shapes, much like you would in Illustrator™, select the lines and use the "Join" command.

Now the two separate objects are one

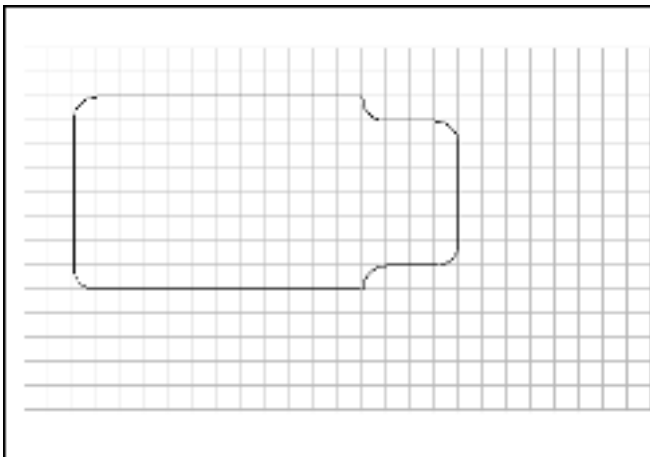
- Select Geometry Modifier tool group and select the Fillet tool.



- Hold down the "Option" key and click on the Fillet tool again.
- Click on each line segment on either side of the top left corner.



- Continue this operation all the way around. Remember that the 3rd and 8th corners go "in" so the 3rd corner is skipped and the 4th corner is filleted inward. Do likewise for the corner on the opposite side of the outline.



- Option-click the Arrow tool when finished to make that tool the default tool.

Now to add rounded corners to this shape we will "fillet" the corners with the Fillet tool. To make our work go faster, we can make the Fillet tool the default tool by Option-clicking the tool. Now the tool will not change back to the arrow tool after each operation. Notice how the tool defaults to .25", which we will not alter. This value can, of course, be edited to any value that will work within the constraints of the geometry that you want to modify.

Start at the top left corner and click on each side of the corner. MacroModel is smart enough to fillet the corner in between the two line segments you click.

Continue this operation for every corner on this outline, skipping the 3rd corner so that we can create an inward curve at this point.

Again we will need to join the geometry so simply repeat the same procedure.

- Marquis select the outline and select "Join" from the Object menu.

Look at the outline from another angle

To look at the work from another angle we can interactively move our view around the MacroModel world. By holding down special command keys we can move wherever we want to interactively



Pan/Rotate/Zoom View

To continue our work simply return to the "Home" view

- Select the Hand tool and, while holding down either the Option or Command key interactively move the view around
- Select "Home" from the View menu to return to the default view.

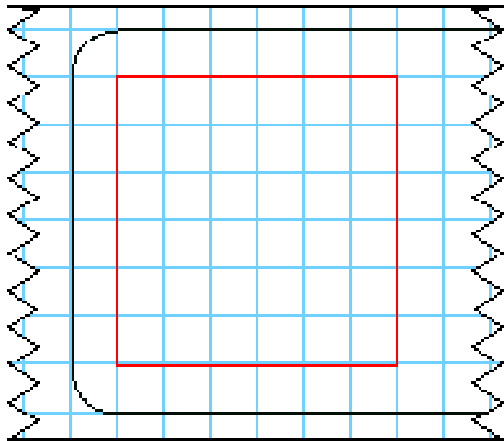
3. Building the Screen

Create the basic screen shape



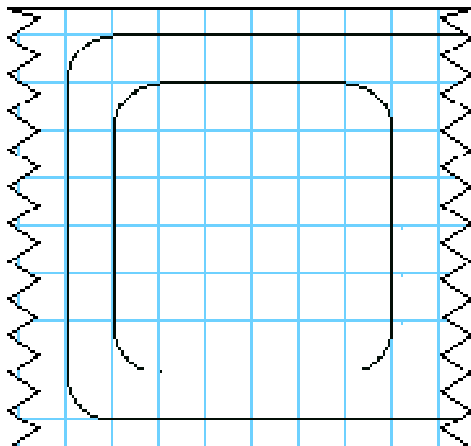
Square

- Get the Square tool and draw a square starting a 1/4" down and in from the top left corner of the outline draw a 1.5" square. The tool bar will read W: 1.5.



.....Fillet

- Select Geometry Modifier tool group and select the Fillet tool.
- Hold down the "Option" key and click on the Fillet tool again.
- Click on each line segment on either side of the top left corner.
- Continue this operation all the way around so that all of the corners are rounded.



Now we will build the Direction 2000's view screen. It will consist of the screen itself and surrounded by a screen trim

Select the Square tool from the rectangle tool group and, starting a 1/4" down and in from the top left corner of the outline draw a 1 1/2" x 1 1/2" square.

To create rounded corners to match the rest of the object select the fillet tool and make it the default tool like before.

Now fillet all of the corners of this square and join them together.

This will be the outline for the screen.

- Option-click the Arrow tool when finished to make that tool the default tool.
- Marquis select the screen outline and select "Join" from the Object menu.

Create the screen

We will be able to use this geometry for two

- Select the screen outline and choose Duplicate from the Edit menu. The new object will be placed to the right of the original.

- Hold down the "H" key and, while holding the mouse down, grab the right side of the object and move it horizontally to the left until it snaps into position on top of the original outline.



.....Extrude

- Select the Extrude tool and type tab so that the default extrude value of 1.0 is highlighted. Type in .025 and type Return to lock-in the value, then either double click or type Enter to create the 3D shape.

3D Snap Extrude depth: .025

- Double click on the middle of the screen object to open it.
- Double click on the middle of the screen object. again to close it.
- Open the "Materials..." browser ...



...and select "Screen" from the material list. Close the browser when finished.

separate objects: the screen and the trim, so lets duplicate this object.

To place it EXACTLY on top of the original, we can constrain motion in only certain directions using "modifier" keys. Here we will use the "H" key to move the new outline horizontally to the left until it "snaps" exactly on top of the original geometry.

Now we will turn this outline into a 3D object, which will be the screen. To do this select the Extrude tool and type in an exact value that we want to extrude to which is .025". Double clicking or typing Enter will initiate the action and create our first 3D shape.

To access the objects geometry for editing we simply double click on the object. To close the access to the points double click again.

To Change the color of the objects we can open the Material Browser and apply a new color. Since the object is already selected all we have to do is pick a new color. In this case we have set-up a list of colors corresponding to this demo, so pick the material called "Screen". Materials can have color, reflectance, specularity, roughness and even Three-D or RenderMan shaders attached. The "Squiggle" at the top will update as you change the values in the Material Browser to give you visual feedback about what type of material you are editing.

Materials		
Control Panel	Material	↑
Track Ball	Material	☰
Screen	Material	☒
Trim	Material	↓

Create the screen trim



Oval

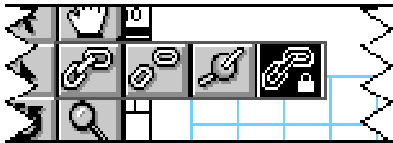
- Select the Oval tool from the Circle tool group and, above the Construction grid draw a horizontally oriented oval whose length does not exceed approximately 1/4"



Sweep

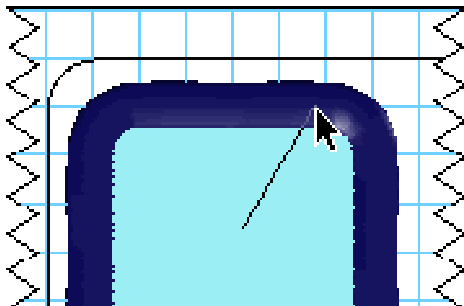
- Select the Sweep tool and click on the oval, then click on the black outline of the screen. The cursor will turn into a crosshair when the arrow passes over the geometry. Double-click or type Enter to create the 3D shape
- Open the "Materials..." browser and select "Trim" from the material list. Close the browser when finished

Linking Objects



Lock Link

- Select the Lock Link tool from the Link tool group.
- With the Lock Link tool selected place the mouse in the center of the screen and hold down the mouse button and drag the line out to the screen trim object. and release the mouse button. Both objects will be highlighted meaning that they are linked together.



To create the screen trim object we will use the "Sweep" tool, which will extrude a shape along a path. The path, in this case, is the screen outline, so we will need a shape to extrude along this path. Lets create a small oval and draw it at the top of the screen.

To "sweep" this shape we will pick the Sweep tool and click on the oval, which will be the cross-section, and the original screen geometry, which will be the path. When these are selected double click or type Enter to create the 3D shape.

Once again the object took on the default color so open the Material Browser and select the "Trim" material from the material list.

To create a real-world relationship between two or more objects, we need to "Link" them together. Linking is a very powerful feature that allows us to create dynamic working models that simulate many of the ways objects work together in the real world. With linking we can produce ball joints, hinges, locked links and a number of physical relationships. In this case we will use a simple "Lock Link" to "bolt" or "glue" these object together.

It is logical that if you created this object for real the screen would be set into the trim so create a link that links the screen TO the trim. Notice now that BOTH objects are selected, meaning now they are linked together.

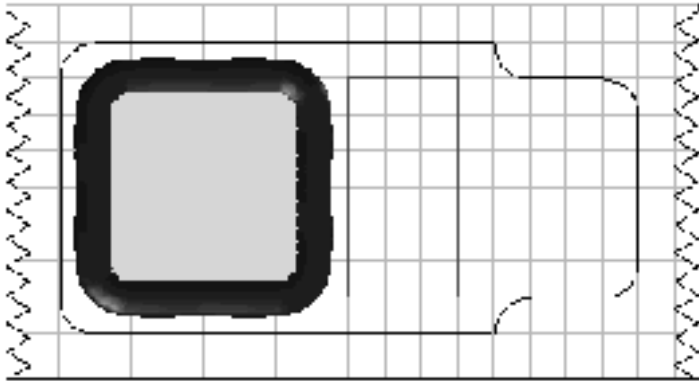
We will see more sophisticated examples of this later in this demo.

4. Building Control Panel



Rectangle

- Get the Rectangle tool and, starting .25" to the right of the top right corner of the screen object, draw a rectangle that measures W: .75" x H: 1.5"



Extrude

- Select the Extrude tool and double-click or type Enter to create the 3D shape

- Open the "Materials..." browser and select "Control Panel" from the material list. Close the browser when finished

To create the Control Panel, where the prototype's input devices will reside, we will use the extrude tool again. We will not place any objects on this panel to represent these input devices, but instead render them onto this object later in Macromedia's Three-D, which is a professional-quality animation and rendering application. If you do not have access to Three-D or any number of other renderers on the market, then you may wish to create 3D objects that show where and how the buttons will be placed

Start by drawing a rectangle that measures 3/4" x 1 1/2". Notice how the number scroll as you draw the object. You could also type in these values just as easily.

To create a 3D object from this rectangle choose the Extrude tool and double click or type Enter. This creates an extruded rectangle that is .025" in height, which is the height that we set for the Screen object. We could have interactively created the object height or typed in a new value if we wanted it to be any different.

Once again the object took on the default color so open the Material Browser and select the "Control Panel" material from the material list.

5. Building the Trackball

Create the base 2D geometry

Changing the Grid dimensions

- Select "Rulers..." from the Object Menu and change "Divisions" from 4 to 8 and close dialog

Using the Center Arc tool



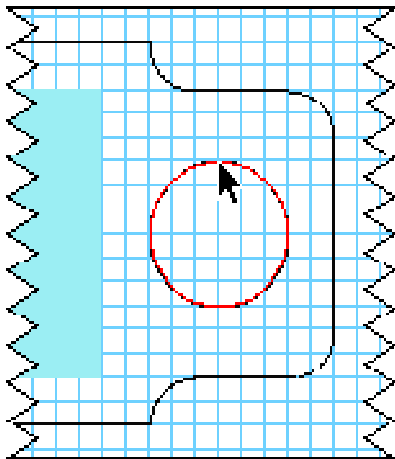
Center Toggle

- Set the draw center/corner-toggle to center



Circle

- Select the Circle tool from the Circle tool group
- Draw a circle, where the Radius equals $.375''$ on the toolbar, placed in the horizontal center and $5/8''$ to the left of the right side of the body outline



In this section we will build a working track ball device for the Direction 2000. The track ball will consist of a ball and a trim ring to hold it in the Direction 2000. Lets start by creating the base 2D geometry for both of these objects. This methodology should be getting familiar by now, for it will a lot like how we created the screen, except we will be using some different tools.

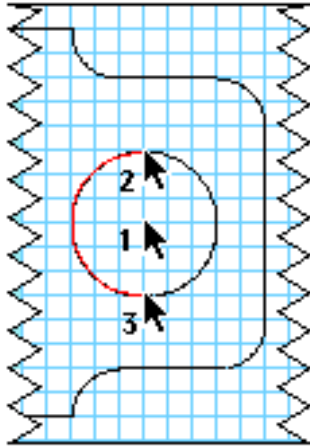
With the Construction Grid at it's current dimensions, we will not be able to place and create the properly sized objects, so lets change the grid dimensions. Currently the grid is set at $1/4''$ divisions, so we will simply change the grid so that it is set at $1/8''$ divisions. At this scale we will be able to create the exact geometry we need and position it properly.

The first thing we will do is draw a piece of geometry that will be the basis for the trackball's trim. Use the circle tool to draw a $3/8''$ circle in the middle of the lower portion of the body outline.



Center Arc

- Select the Center Arc tool from the Arc tool group
- Draw a 180° arc by clicking first on the circle's center, then click vertically to the top of the circle so that the Radius equals .375" on the toolbar and finally click vertically to the bottom so that the Angle equals .180° on the toolbar



Next we will draw a piece of geometry that will become the trackball itself. Using the Center Arc tool, we will draw a half circle in the same place as the ring. Notice how the numbers on the toolbar are giving us accurate numeric feedback about the dimensions of this arc.

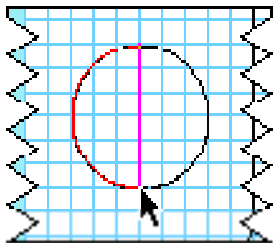
Create the base 3D Trackball

- The arc should still be selected



Lathe

- Select the Lathe tool and click, first, on the top end of the arc and, second, on the bottom end of the arc. The lathe tool will automatically initiate the creation of the object.



To create the actual 3D trackball, we will use a new 3D tool called the "Lathe" tool. The Lathe tool will rotate a piece of geometry, to any specified angle, around a user-specified axis. For example to make a sphere from this arc, all we have to do is specify an axis that is defined by the two open ends of this arc. The lathe tool will then rotate this arc 360°, the default value, around this axis to create a sphere.

- Open the "Materials..." browser and select "Trackball" from the material list. Close the browser when finished

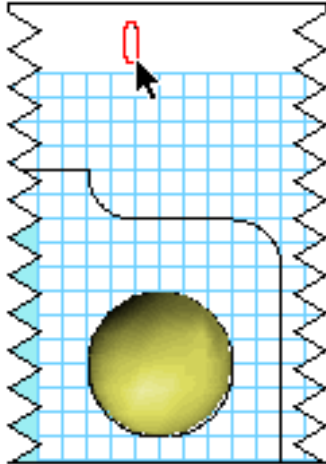
Once again the object took on the default color so open the Material Browser and select the "Trackball" material from the material list.

Create the base 3D Trackball trim



Oval

- Select the Oval tool from the Circle tool group and, above the Construction grid draw a **vertically** oriented oval whose height does not exceed approximately 1/4"



Sweep

- Select the Sweep tool and click on the oval, then click on the black outline of the screen. The cursor will turn into a crosshair when the arrow passes over the geometry. Double-click or type Enter to create the 3D shape
- Open the "Materials..." browser and select "Trim" from the material list. Close the browser when finished

Linking Objects



Ball Link

- Select the Ball Link tool from the Link tool group.

To make the ring that holds the trackball, we will use the same process we used to create the trim for the screen.

To create the trackball trim object we will use the "Sweep" tool again. The path, in this case, is the we drew at the beginning of this part of the demo. The object that we sweep along this path will be another oval.

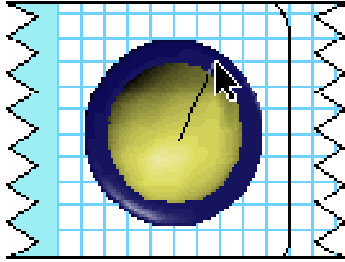
Lets create a small oval, much like we did for the screen trim, and draw it at the top of the screen.

To "sweep" this shape we will pick the Sweep tool and click on the oval, which will be the cross-section, and the circle that surrounds the new 3D trackball object, which will be the path. When these are selected double click or type Enter to create the 3D shape.

Once again the object took on the default color so open the Material Browser and select the "Trim" material from the material list.

Just as we did for the screen object, we will need to create a real-world relationship between the trackball and the trackball trim objects. There fore we will need to "Link" them together. In the first example we used a "Lock Link" to lock both the attitude and the position of the objects relative to each other, but in this example we will use a "Ball Link" instead. A Ball Link will lock the position, but not the attitude. This means that the trackball can rotate freely in the trim, just like it would if it were a real assembly.

- With the Ball Link tool selected place the mouse in the center of the trackball object and hold down the mouse button and drag the line out to the trackball trim object. and release the mouse button. Both objects will be highlighted meaning that they are linked together.



It is logical that if you created this object for real the trackball would be set into the trim so create a link that links the trackball TO the trim. Notice now that BOTH objects are selected, meaning now they are linked together.

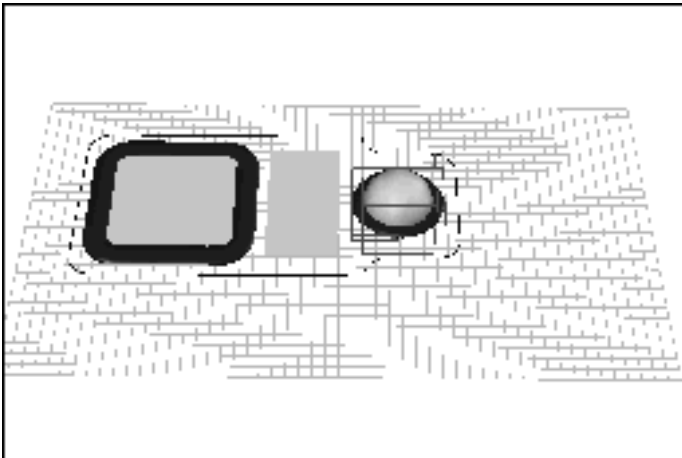
Look at the work -in-progress from another angle



Pan/Rotate/Zoom View

- Select the Hand tool and, while holding down either the Command key interactively move the view by pushing the depressed mouse from the bottom of the screen to the top so 45° view is created.

To look at the work from another angle we can interactively move our view around the MacroModel world. By holding down the Command key we can move interactively to another view looking down on the work we have done thus far.

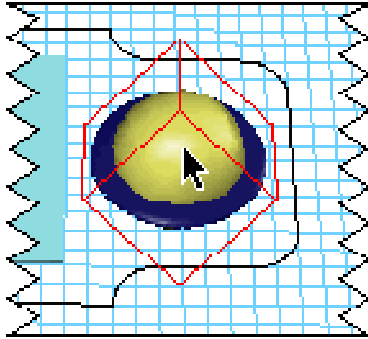


Interactively manipulate linked objects



Arrow

- The Arrow tool will be automatically selected because it is the default tool. Place the Arrow over the center of the trackball object and click and hold down the mouse button, while, at the same time, holding down the Option key. While BOTH buttons are being held down slowly move the mouse around the workspace to see the trackball object rotate.



To see how the trackball will actually work all we have to do is click and hold on the trackball object and, while holding down either the Option or Command keys like for the views, move the mouse around the screen. Notice how the trackball moves only it's orientation, just like a functioning trackball would actually work!

6. Building the Product Body

Managing the model

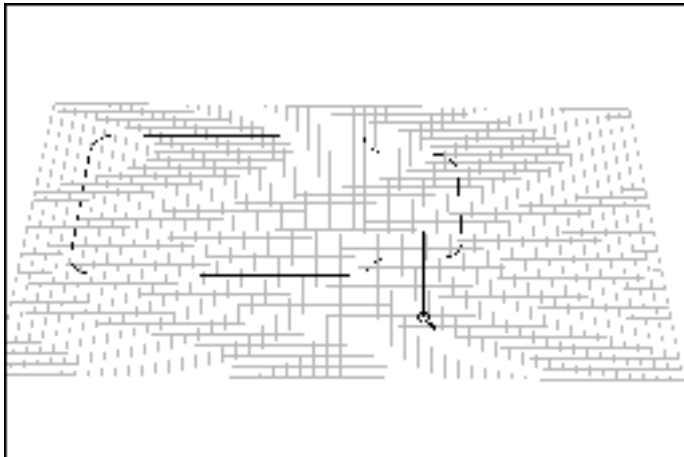
- Click on the **Screen Trim** object and shift-select the **Control Panel** and **Trackball Trim** objects so that **all** objects in the model are selected. Since the Screen Trim and Trackball Trim objects are *parent objects* of the objects that they contain, the entire assemblies will be chosen.

Creating the body object



Zoom

- Select the Zoom tool and draw a marquee around the 90° corner located closest to the lower edge of the screen. The marquee should be roughly 3x larger than the corner element that you are zooming in to. The numeric zoom percentage, located in the toolbar, should read roughly 5.0.



To build the body of the product we will use the body outline that we constructed at the beginning of this demo. First, though, lets *manage* our model. this means that we will "hide" objects that we are finished working on so that we can work more efficiently and faster.

We will, therefore, hide the objects that we have created thus far; the Screen Assembly, the Control Panel and the Trackball Assembly. To "hide" these objects shift select all of the objects and initiate the "Hide Selected" command from the Object Menu. The objects haven't been deleted...only hidden from view. This means that the redraw time will be significantly faster because we don't have to redraw those objects everytime we change something in the model.

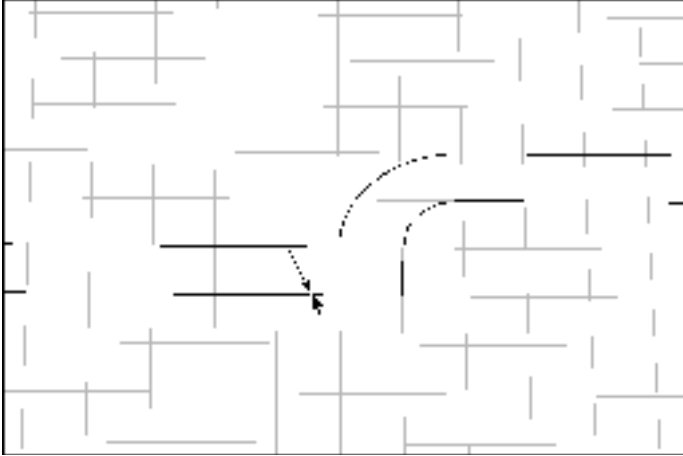
To create the Direction 2000's main body we will ultimately use the "Skin" tool to create it, but before we can use this tool we will have to set-up the 2D geometry to create a 3D object.

Lets start by zooming into a part of the body outline. With the zoom tool draw a marquee around the 90° corner located closest to the bottom of the screen

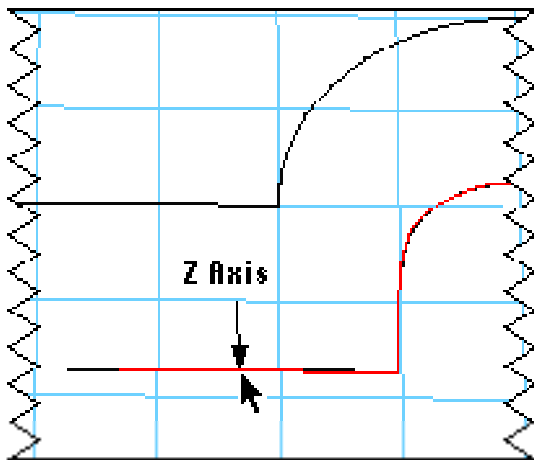


Offset

- Select the Offset tool from the geometry modifier tool group. Place the arrow on the lower edge of the body outline and click and drag down until the new line "snaps" to grid 1/8" outside the original object.



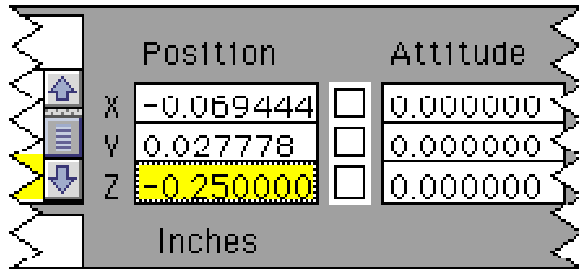
- Hold down the "N" key so that "Normal" is displayed in the toolbar and place the Arrow over the new outline so it turns into a cross-hair. Click and push forward so that the new outline is roughly 1/8" below the original.



Next to make this body have round edges we will need to create a parallel copy of this geometry and move it below the current outline. To do this we will start by picking the Offset tool, which makes parallel copies of 2D geometry. This is far more useful than a simple scale, because all lines are perfectly parallel around the 2D object. Now use the tool to create a parallel copy of the body outline 1/8" larger than the original.

Next we will move this new piece of geometry *down*, or in the *negative z direction* from where it is currently placed. As stated in the beginning of the demo all drawing and manipulation is done on a working plane. All work we have done thus far has been *across* this working plane, or along the x and y axis'. To move an object perpendicular, or in the z axis, relative to the working plane, we can use a special constraint key to do this. Like we moved the screen geometry horizontally by holding down the "H" key, here we will move in the z axis, or up and down, by holding down the "N" (normal) key. So hold down the "N" key and place the Arrow over the new outline so it turns into a cross-hair and click and push forward so that the new outline is roughly 1/8" below the original.

- Click on the Construction Grid to select it.
- Open the "Objects..." browser in the Objects menu.
- Type -.25 in the **Z** field of the **Position** dialog section of the Object browser and type Return to lock-in the value.

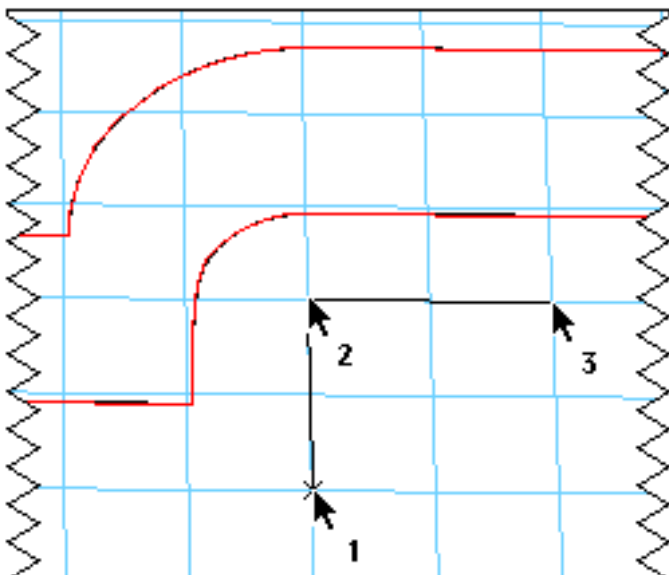


- Close the Object browser when finished.
- Shift-select the two outline objects and duplicate by choosing Duplicate from the Edit menu. The new geometry will be placed to the right of the originals.
- Hold down the 3 key and place the arrow over one of the two hard corners of the duplicated objects and click and drag that corner to the corresponding corner on the original outline.



3D Mirror

- Select the 3D Mirror tool from the Mirror tool group and click on 3 points on the Construction Grid. The duplicated outlines should mirror themselves on the opposite side of the Construction Grid.

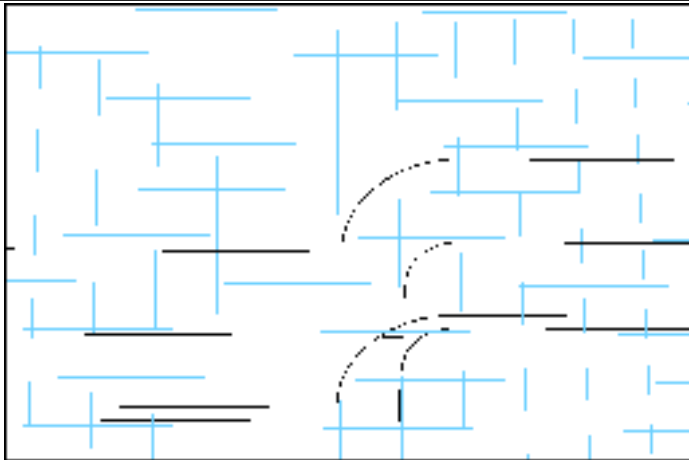


Click 3 Points on the grid...

The next step in creating the body will involve duplicating these two objects and "mirroring" them over the construction grid. In the last step we moved the new outline interactively, but what if we wanted exact placement? In this example we will move the Construction Grid exactly 1/4" below where it exists now so that we can mirror the duplicated geometry over it. To do this, select the grid by clicking on it and then opening the Object Browser. To numerically change the Grid's position simply type in -.25 in the Z field of the Position dialog section of the browser and type Return. See how the Grid has changed position. It is now 1/4" below where it originally was.

The next step in creating the body geometry is to duplicate the two outlines and match them to the originals. First shift-select the two outlines and duplicate them. Now place the arrow on one of the two hard corners of the duplicated geometry and, while holding down the "3" key, place the duplicated corner on the corresponding corner of the original outline. See how the corner "snaps" to the original corner. The "3" key stands for 3D snap, which allows us to snap all sorts of points, lines and surfaces to any other geometry in the MacroModel, regardless of the position and orientation of the Working Plane

The last step in setting up this geometry is to now "mirror" these duplicated outlines to the opposite side of the Construction Grid. MacroModel has both 2D and 3D mirror tools. 2D mirror tools are found in virtually every draw program and simply mirror a selected piece of geometry over a line, which is a 2D element. Since MacroModel is a 3D program, the functionality of the tool has been expanded to allow you to mirror over a 3D plane. While a line is designated by 2 points, then a 3D plane is subsequently designated by 3 points. Picking 3 points on the Construction Grid will then mirror these objects to the other side.



...to mirror over a grid



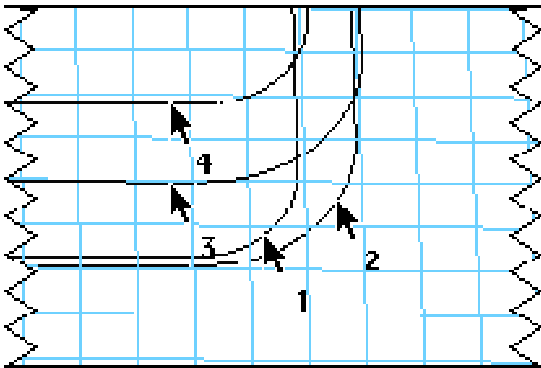
Pan/Rotate/Zoom View

- Select the Hand tool and, while holding down the Control key press the mouse button and push the mouse up in the workspace.



Skin

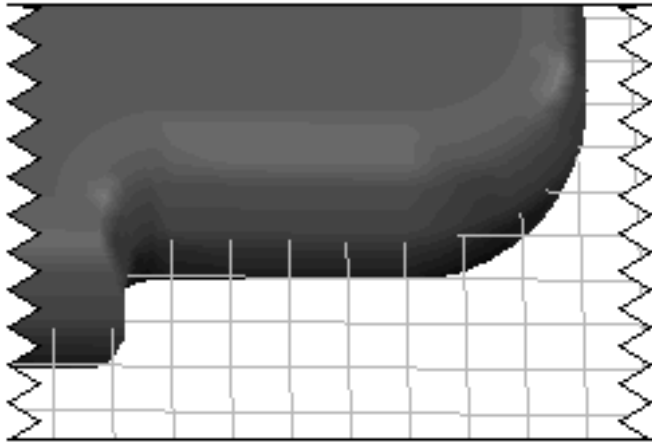
- Select the Skin tool and start by placing the arrow over the top-most outline and click to select it. Continue selecting the other three outlines in the same manner in a **top to bottom** fashion.



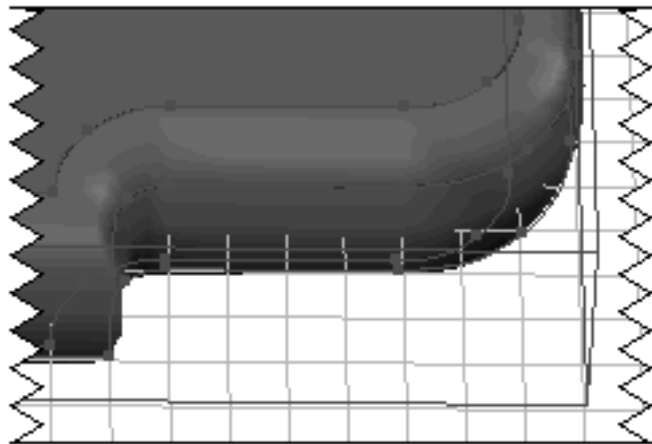
Double-click or type Enter to create the 3D object.

Now to actually create the body object, we will skin all of these outlines. First interactively zoom out from the view we are in currently to get a better view of the object body.

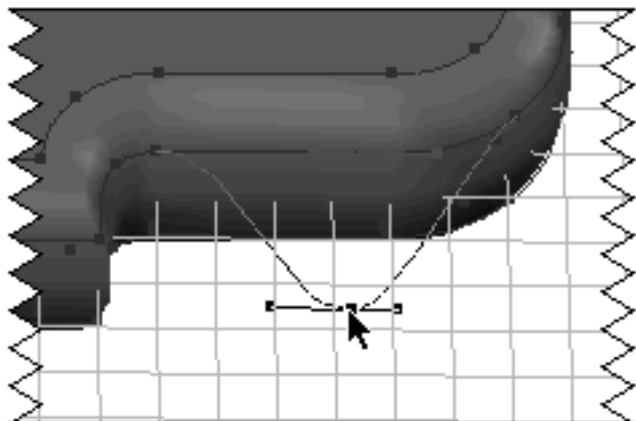
To create the body select the Skin tool. The Skin tool does exactly what it's name implies, it puts a "skin" over two or more pieces of 2D geometry to create a 3D surface. In this case the four outlines will be skinned to create the body of the Direction 2000. Start by choosing the 2D geometry from top to bottom, starting with the original piece that was created at the beginning of the demo and moving sequentially down to the bottom-most 2D outline. When all of these elements have been selected double click or type Enter to create the 3D object.



- Double-click on the new object.

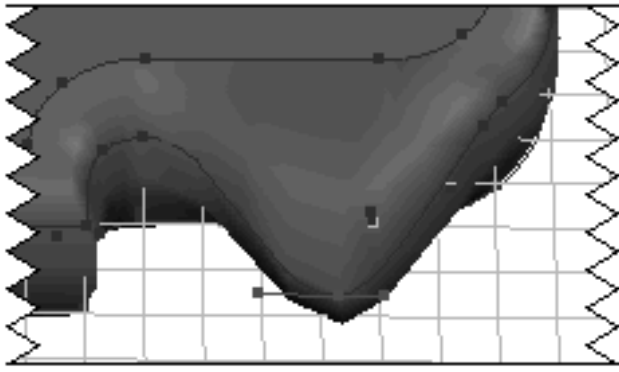


- Place the Arrow over an active control point and click and drag the point. Let go of the mouse button when finished moving the point and the shape will redraw in it's altered form.



One of the most powerful feature MacroModel has to offer is the fact that even 3D objects can be edited. If we double click on this new object, we will see the original outlines that created it.

By selecting on of these control points and moving it, we can edit the 3D shape.



- Select Undo Last from the Edit menu

- Double-click on the new object to close points.

MacroModel also feature 5 levels of undo, so we can journal backwards a number of steps. With this we can undo the edit we just performed.

To "close" the object, double click on it.

7. Building the Antenna

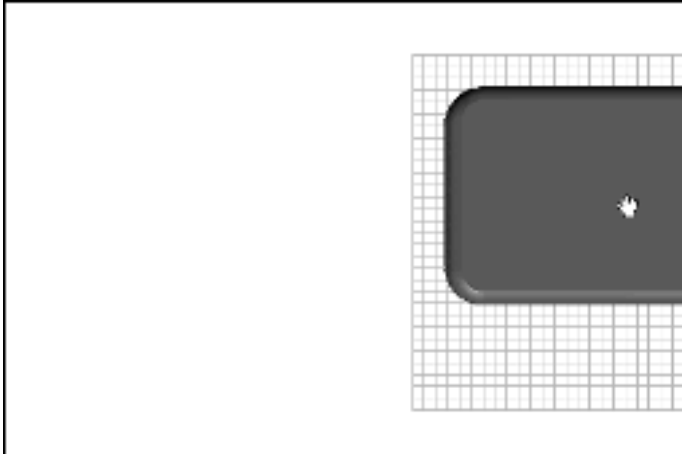
Setting-up the Work View

- Select Home from the View menu



Pan/Rotate/Zoom View

- Select the Hand tool and click and drag the Hand tool from the center to the right side of the workspace, so that the body is positioned half off the screen.

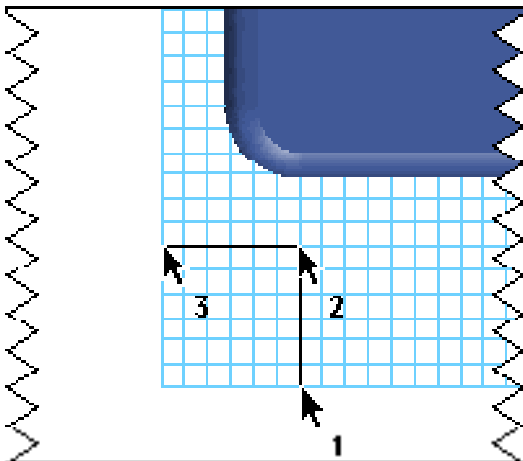


Change the Working Plane



Working Plane

- Select the Working Plane tool to. Click on 3 points in a **counter-clockwise** fashion on the Construction Grid.



The last element of the model we will build will be the Direction 2000's extendible antenna.

To create this we will set-up our workspace by first going back to the "Home" view and using the hand tool to pan the view so that the body of the Direction 2000 is on the right side of the screen.

The second procedure will be to place the Working Plane, currently placed on top of the Product Body, so that it is aligned with Construction Grid. The Working Plane tool will allow me to place the Working Plane on a variety of points, lines or surfaces. In this demonstration we will just use points. Like the 3D Mirror tool needs 3 points to define a plane, so does the Working Plane. By designating 3 points on the Construction Grid, we can align the Working Plane to that object.

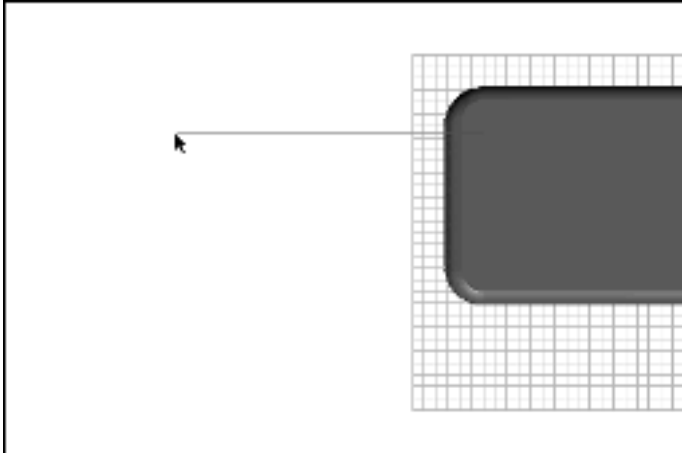
The reason we moved the Working Plane was so that we could draw the antenna so that it lies in the center of the body. Remember that all objects are drawn and moved across the working plane.

Build the 2D Geometry



Line

- Select the Line tool and, while holding the "V" key down, draw a line starting at the top/left of the body and going horizontally left. The tool bar will start scrolling and stop drawing the line when the value in the toolbar is approximately 3".



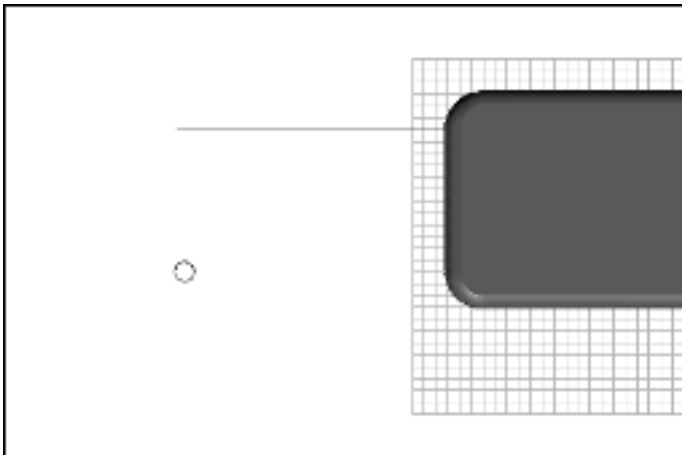
Center Toggle

- Make sure that the draw center/corner-toggle is set to center



Circle

- Select the circle tool from the circle tool group and draw a circle in the lower left hand part of the workspace that measures approximately .1".



To build the 2D geometry that makes up the antenna draw a horizontally constrained line that extends from the top left-hand corner of the Direction 2000's Body. Since we will be using the Sweep tool to create this shape, we will need to create an object to sweep along this new line.

With the Circle tool draw a circle that has an approximate radius of .1". The toolbar will give you feedback as to the exact size of the circle.

Build the 3D Geometry



Sweep

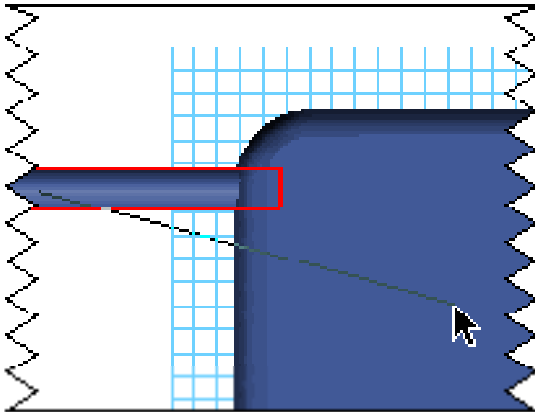
- Select the Sweep tool and click on the circle, then click on the line. The cursor will turn into a crosshair when the arrow passes over the geometry. Double-click or type Enter to create the 3D shape

Linking Objects



Lock Link

- Select the Lock Link tool from the Link tool group.
- With the Lock Link tool selected place the mouse in the center of the antenna object and hold down the mouse button and drag the line out to the product body. and release the mouse button. Both objects will be highlighted meaning that they are linked together.



To create the antenna we will use the sweep tool to simply sweep the circle along the line, which is the path.

Just as we did for the screen and the trackball objects, we will need to create a real-world relationship between the antenna and the product body. Therefore we will need to "Link" them together. In the first example we used a "Lock Link" to lock both the attitude and the position of the objects relative to each other. In this example we will use the Lock Link again, but this time we will modify the link.

As for the screen assembly, lock linking will lock both the position and attitude of these two objects relative to each other. In order for the antenna to travel linearly in and out of the Product Body we will have to modify the link. But first we have to modify the view.

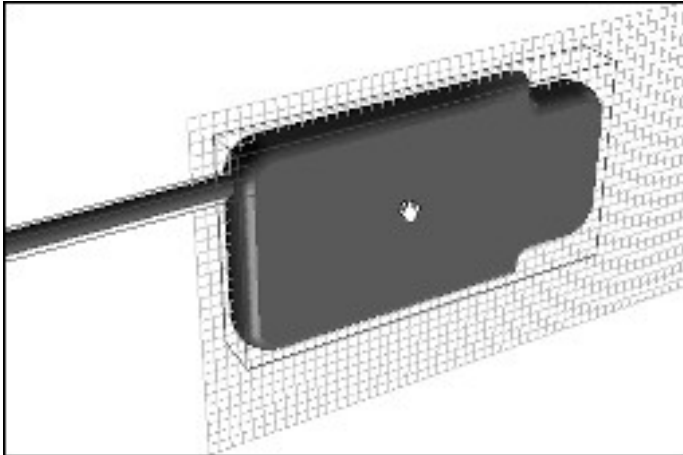
Look at the work -in-progress from another angle

- Select the Axonometric view found in the Orient list in the View menu.



Pan/Rotate/Zoom View

- Select the Hand tool and place the hand in the center of the workspace and depress the mouse and drag the mouse until the objects are centered in the workspace.

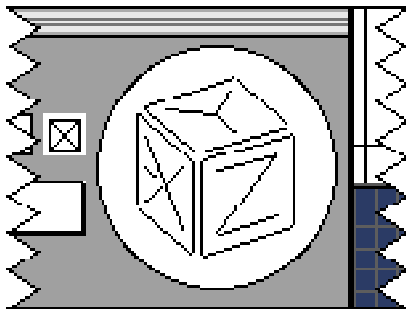


Using the pre-scripted "Axonometric" view we can shift to a view that allows us to see the top of the product body and antenna.

We can then center the view with the Hand tool by panning the antenna to the center of the screen.

Changing the link

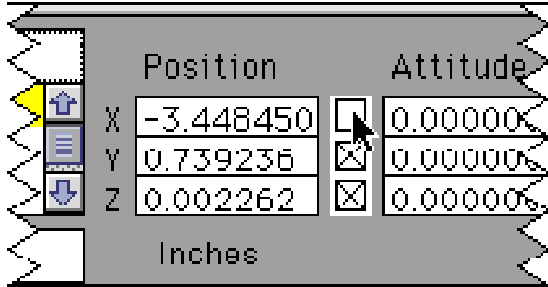
- Click on the antenna to select it.
- Open the "Objects..." browser in the Objects menu.



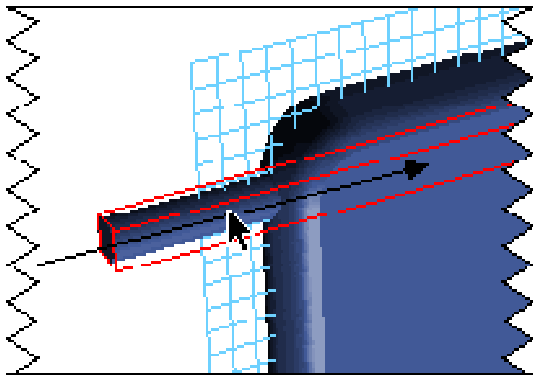
To change the link of the antenna, select the object and open the Objects browser box. You will notice that the position and attitude boxes are all checked. To create a link that allows the antenna to move in only one direction, up and down relative to the product body, we need to *unlock* one of the position boxes.

MacroModel has a feature called a "Virtual Trackball" that gives us a visual representation of the orientation of selected objects. Notice that, for the selected antenna, the "X" face of the trackball lines-up with the top of the antenna.

- Deselect the "X" position lock by clicking on the checked box to the right of the X field in the Position field of the browser.



- Close the Object browser when finished
- To move the object, click the arrow on the antenna and drag to the right and left.



Finishing the model

- Untoggle Hide Objects from the Objects menu.



Lock Link

- Select the Lock Link tool from the link tool group.
- Option-select the Lock Link tool so it will be the default tool and link the :
 1. Screen Trim to the Product Body
 2. Control Panel to the Product Body
 1. Trackball Trim to the Product Body

If we unlock the "X" position, we therefore unlink that part of the lock link, which allows the antenna now to move freely in that one direction.

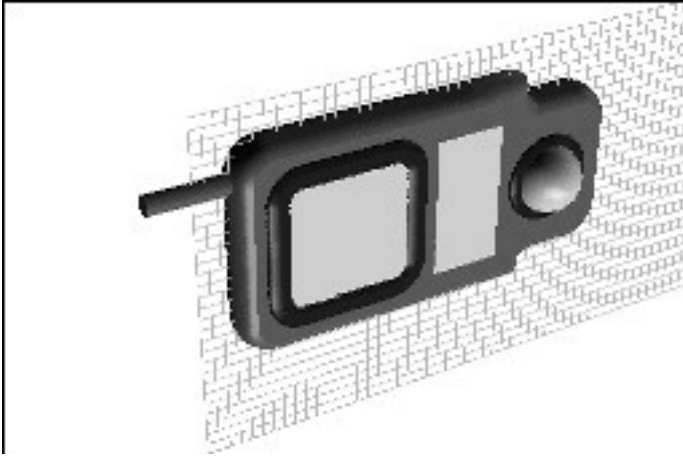
To finish the model we need to link the hidden elements of our model to the product body. Deselecting Hide Objects brings all of the objects back into view.

Now lets finish the model by lock linking all of the elements to the product body.



Arrow

- Option-select the Arrow tool so it will be the default tool.
- Click in the workspace to deselect the objects.



The model is now finished and ready for presentation viewing!

8. Viewing the Model

Final viewing of the model

- Open the "Views..." browser in the View menu.
- From the list of saved views click on "Final View"
- Close the View browser when finished

Clearing the construction geometry

- Choose Clear Construction Objects from the Objects menu



The last element of developing the Direction 2000 prototype is viewing the model. MacroModel has the ability to save any number of views. In this demo file there is a saved view named "Final View".

Notice the View browser is very similar to the Object browser. The Virtual Trackball now tracks the orientation of the view, not the objects here. Notice also that when we select the Final View from the list of saved views that the view has a colored background attached.

To finally present the prototype we will "clear" the construction geometry.

This is the final presentation view of the Direction 2000 prototype in MacroModel! Now on to Macromedia's Three-D for animation and photorealistic rendering!

CONCLUSION

You have seen how MacroModel can take an idea and turn it into reality. MacroModel has allowed us to create a CAD accurate, curved-surface model of the Direction 2000 long before we would have to create a physical prototype of the product. Furthermore, this model can be used by project engineers to actually create that physical prototype, used in conjunction with a CAD program like AutoCAD™, and graphic artists can use the same model to create photorealistic images and animations to sell the idea, used in conjunction with an animation and rendering program like Three-D.

MacroModel's flexibility means that you can even go back and change that model just as easily. Without a doubt, MacroModel is the tool of choice for a wide variety of design professionals!