Having created a model of your part it is often necessary, dependant on the manufacturing technique, to develop a mould system for injection moulding or casting. This document introduces the process of producing moulds covering the creation of mould halves from the defined part. It does not cover other aspects of mould creation such as adding mould filling channels, ejection pins etc.

The tutorial starts by assuming you already have a part designed and this is suitable for moulding. You should use the standard part provided for this tutorial. This part can be downloaded from the internet and can be found at http://www.staffs.ac.uk/~entdgc/WildfireDocs under the Casing link in the Basic Moulding section. Save this part to your working directory.

PREPARING TO MOULD

Before we start to create the mould it would be good to check out the part to be moulded. Choose FILE > OPEN and choose the name casing.prt to load the part we are to mould.

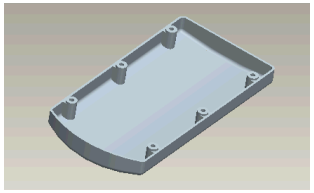


Figure 1 : The Casing Model

You should see the bottom half of a casing for an electronic hand held device in the Pro Engineer window as shown in Figure 1. If you can't find this part check that you have downloaded it correctly from the website and you saved it in the current directory. There is nothing unusual about this part but to make life a little easier for the moulding process we can create a coordinate system in the part. A coordinate system defines the origin and the X, Y and Z directions of a model. To define a coordinate system choose INSERT > MODEL DATUM > COORDINATE SYSTEM. A dialog will be displayed. Select whilst holding CTRL the 3 datum planes in the mould part. Choose them in this order – CASING_RIGHT, CASING_FRONT, CASING_TOP. Since we have picked 3 datums Pro Engineer assumes we want an origin defined at intersection point of all the datums. The order that we picked the datums defines the X, Y, Z directions. Go to the properties tab and type in the name CASING_ORIGIN then click OK to create the coordinate system. Save the part.

The first step in the process of creating moulds from a model is to create a new file in which to work. Choose FILE > NEW and in the subsequent dialog box choose the options for MANUFACTURING and MOLD CAVITY and type in the name mould. Choose the mmns_mfg_mold template. This creates a new assembly ready for the definition of the mould.

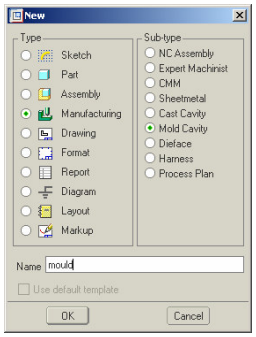
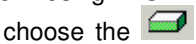


Figure 2 : Creating a Mould Manufacturing Part

PLACING MOULD COMPONENTS

Into this mould we need to assemble all of the parts to make the mould. In this simple case this means the actual part to be moulded and the block of material from which the mould will be made.

Start with the actual part to be moulded since we already have that. Choose the  icon and choose the part casing.prt from the list. A dialog will appear entitled Create Reference Model – choose the SAME MODEL option and OK. Then the layout dialog will be shown. Since we have a coordinate system in both parts this is automatically filled in for us aligning the coordinate system in the casing with the one in the mould. The layout section of the dialog allows you to create a mould with multiple cavities (or impressions). We only want one so leave this set to SINGLE and press OK. The casing should appear in the graphics window.

Now we need to place a block of material (called a workpiece) around this part. If we had a suitable block already defined we could simply ASSEMBLE it using the WORKPIECE option. Since we do not have a suitable block already defined we can create one now using MOLD MODEL > CREATE > WORKPIECE > AUTOMATIC or choose the  icon.

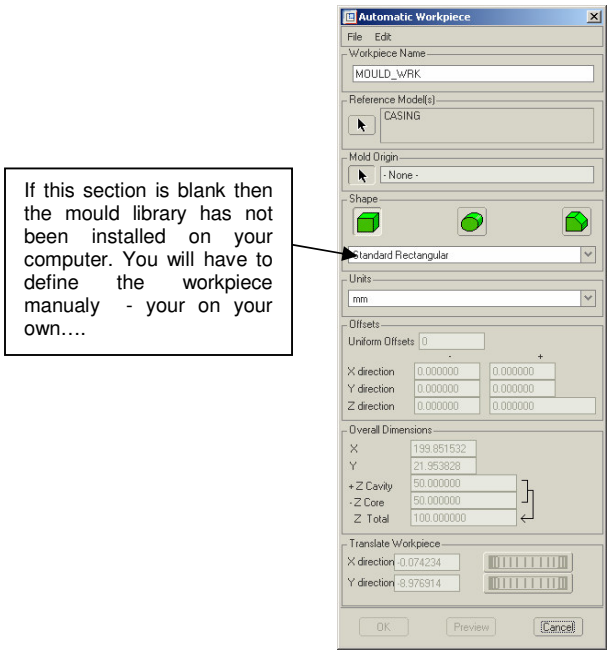


Figure 3 : Workpiece Creation Dialog

The first thing this dialog is expecting is for you to select a coordinate system on which it will base the workpiece material. Select the MOLD_DEF_CSYS coordinate system. Now type in a UNIFORM OFFSET of 10 and preview the block then click OK.

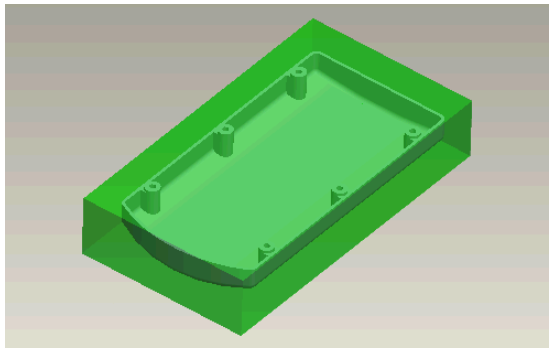


Figure 4 : Workpiece Defined

SPLITTING THE MOULD

We now have the part to be moulded and the material from which the mould is to be made positioned correctly together. The next stage is to prepare to split the material block into two halves to make the mould. To do this we need to define another feature that will act as the 'knife' to cut the material in two halves. This feature defines the split-line in this case a flat plane. You could do this using the command PARTING SURF > CREATE but we will use the automated icons provided. First choose the  icon and simply click OK in the following dialog as all options are correctly defined automatically. You should see red lines appearing in the model as shown in Figure 5. These lines indicate where the casing will be split to create the mold. You may be thinking how does Pro Engineer know where to split it? The answer is simple it infers much of the information from the location of the original coordinate system which is why when we defined the first coordinate system in the casing model the location was important as this defined the position of the split and also the orientation was important as the Z axis defines the direction of the split.

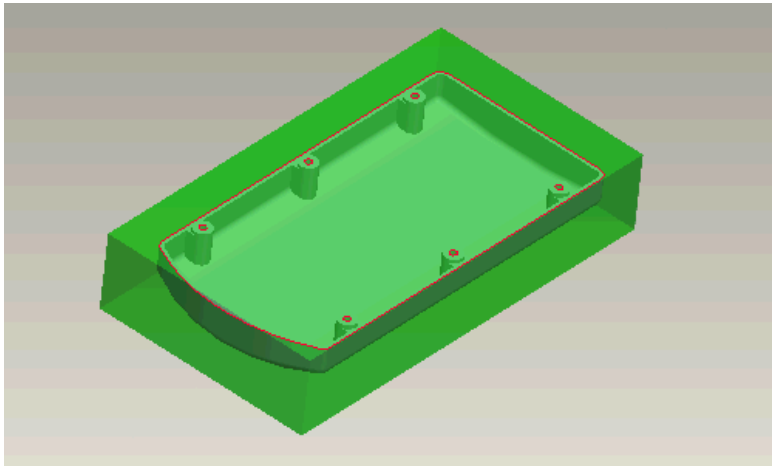


Figure 5 : The Split Lines

The next step is to use these curves to define a split surface which will eventually be used to cut the mould into two parts. Choose the  icon and type in the name MOULD_SPLIT_SURFACE. Click OK then select the red curves you just created followed by Done and OK. A new surface

will be created inside the material (Figure 6) which we will now use to cut the mould into two parts.

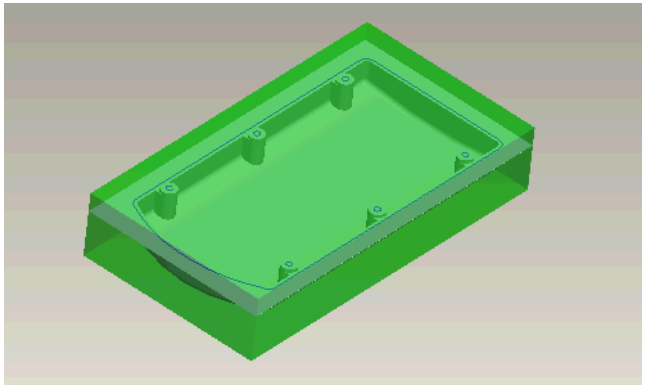


Figure 6 : Split Surface

Now we have the split surface we can use this to chop the mould material into two halves. The command structure for this is MOLD VOLUME > SPLIT or chose the  icon then TWO VOLUMES | ALL WRKPCS | DONE. Now pick the split surface you just created then OK and OK on the dialog box. Accept the names provided for the two halves of the mould and if you want use the Shade button on the Volume Name dialog to see each part as it is created.

This operation has split the model into the two halves ready to define the mould. The information for the two halves is not yet stored as a solid model. It is in fact just a collection of surfaces. Before we proceed we must convert these to solids. This is done with the command MOLD COMP > EXTRACT or the  icon and choosing all of the parts with  from the dialog box and OK. This operation has created two separate parts (mold_vol_1.prt and mold_vol_1.prt), that can be retrieved individually and used (e.g. machined).

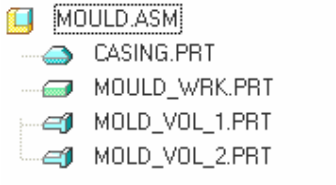


Figure 7 : The Model Tree Dialog Box

VIEWING THE MOULD

To better see what this procedure has done look at the Model Tree (se Figure 7). This shows that mould.asm contains four items…

1. CASING.PRT This is the model of the lower half of the casing.
2. MOLD_WRK.PRT The model of the block of material we created.
3. MOLD_VOL_1.PRT The model of the mould upper half.
4. MOLD_VOL_2.PRT The model of the mould lower half.

It's easier to see the two mould halves if we first make some information invisible and then 'open' the mould. At the top of the main window you should see an icon  . Click this to bring up the Blank/UnBlank dialog.

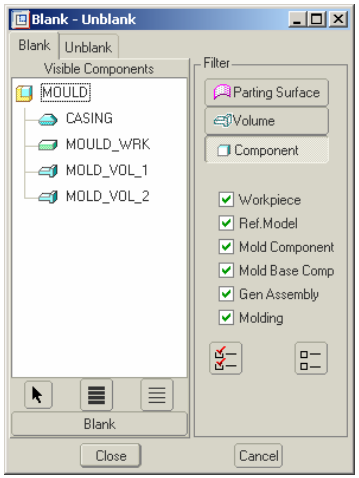
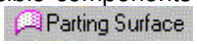


Figure 8 : The Blank - UnBlank Dialog Box

In this dialog click on the name MOULD_WRK below visible components and press BLANK at the bottom of the dialog. Now press 

and blank the parting surface. Close the dialog. This leaves just the two mould halves and the casing visible but with the mould in the closed position. The open position of the mould is defined by the command MOLD OPENING or the  icon. Now choose DEFINE STEP > DEFINE MOVE and pick the top half of the mould. To define the move direction click on one of the vertical edges of the mould and type in a distance of 100 Done. Repeat this for the lower half moving it down by -100. The drop down menu command VIEW > EXPLODE > EXPLODE VIEW controls the movement of the model between its open and closed state.

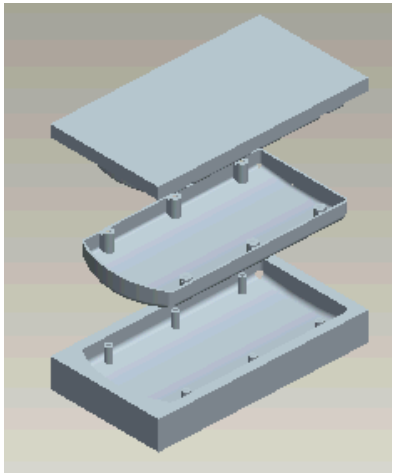


Figure 9 : The Completed Open Mould

Review

So what should you have learnt?

- How to define coordinate systems for moulds.
- How to create and locate basic mould components.
- How to split into mould halves.
- How to show mould components in the open position.

Any problems with these? Then you should go back through the tutorial – perhaps several times – until you can complete it without any help.