SBS Vacuum-forming.

SAFETY

Introduction:
Vacuum-forming is a very handy and simple modelling technique to learn and master as it will allow you to produce shapes and forms not easily made using other techniques, for example the compound curves of front or rear fenders or truck cabs.

Overview:
Basically all that is done is to heat some sheet plastic till it becomes pliable then the sheet plastic is placed over the *master pattern* on a *vacuum-box* and vacuum applied which pulls the plastic down and around the *master pattern* creating your new part.

Equipment Requirements:
a.   Vacuum cleaner
b.   Vacuum box
c.   Sheet holding frame(s)
d.   Sheet plastic
e.   Master pattern
f.   Heat source (oven)
g.   Raising blocks

The Equipment.
Vacuum Box - first you will need a box, there are commercially available boxes but for around $10-20 you can build one yourself using basic tools with the advantage of a custom size to suit you.
The example shown in the photo measures 300x300x70mm (12x12x3") made from scrap MDF (or any wood laying around). The top plate on the example is Perspex with multiple holes drilled for the vacuum (note the dowelling to support the centre). In the base of the box is a piece of tubing to fit the vacuum nozzle. The main requirement is that the internal or external joints are sealed.
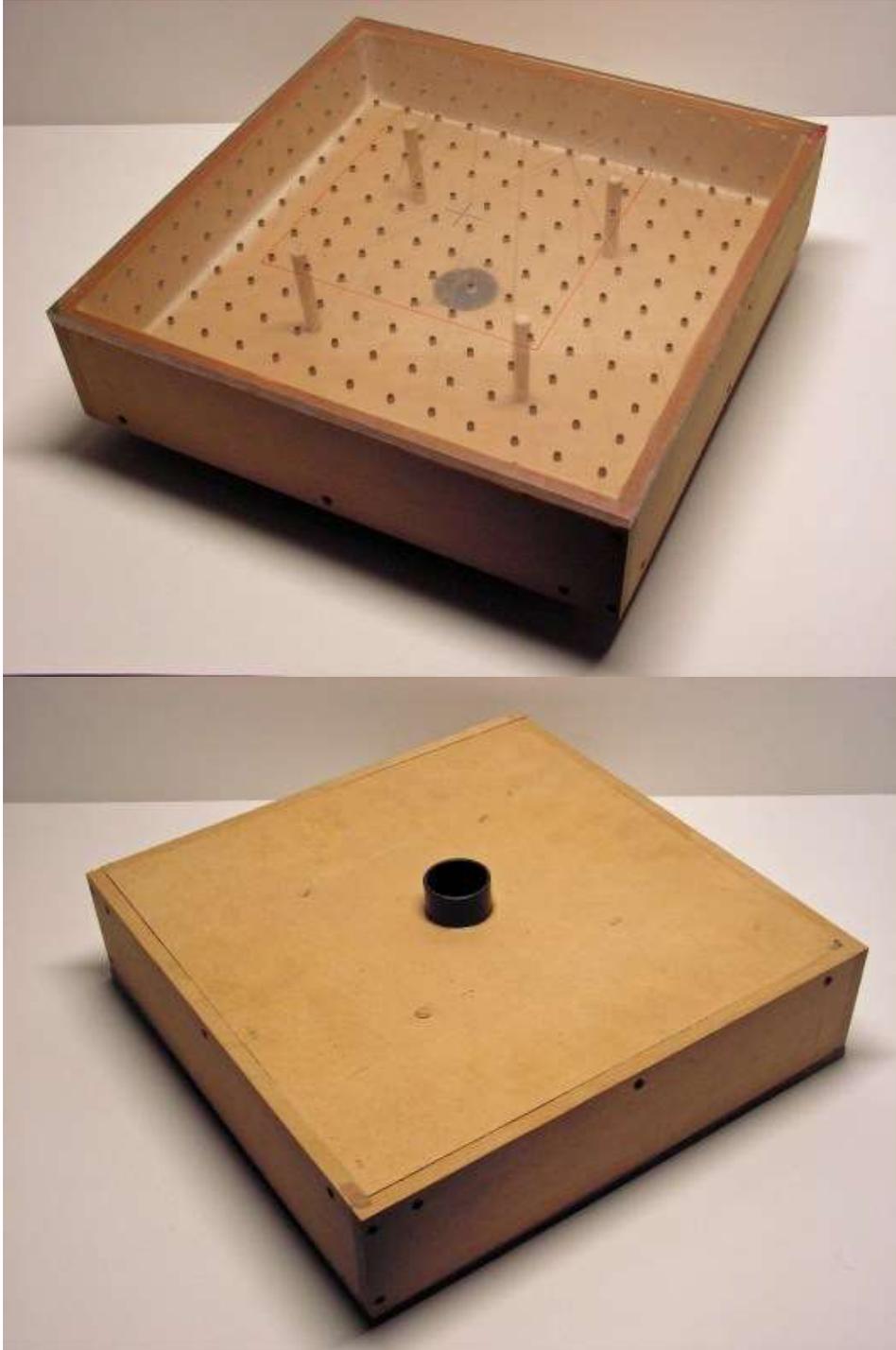
Sheet frames - these are to hold the sheet plastic while it is heating in the oven, the examples shown are MDF with small bolts epoxied to the bottom frame.
The deciding factor on frame sizes will depend on:
A. your oven size
B. what scale you work in,

The largest frame I use is 300x300mm (12x12") but the 150x150mm (6x6") frames are used for the majority of forming tasks. If using a smaller frame than the *Vacuum Box* you will need to seal-off the vacuum holes on the box that are not covered by the frame.
NB. The frames need to be made from a non-heat conducting material (wood/alloy) do not try using steel - it doesn't work.
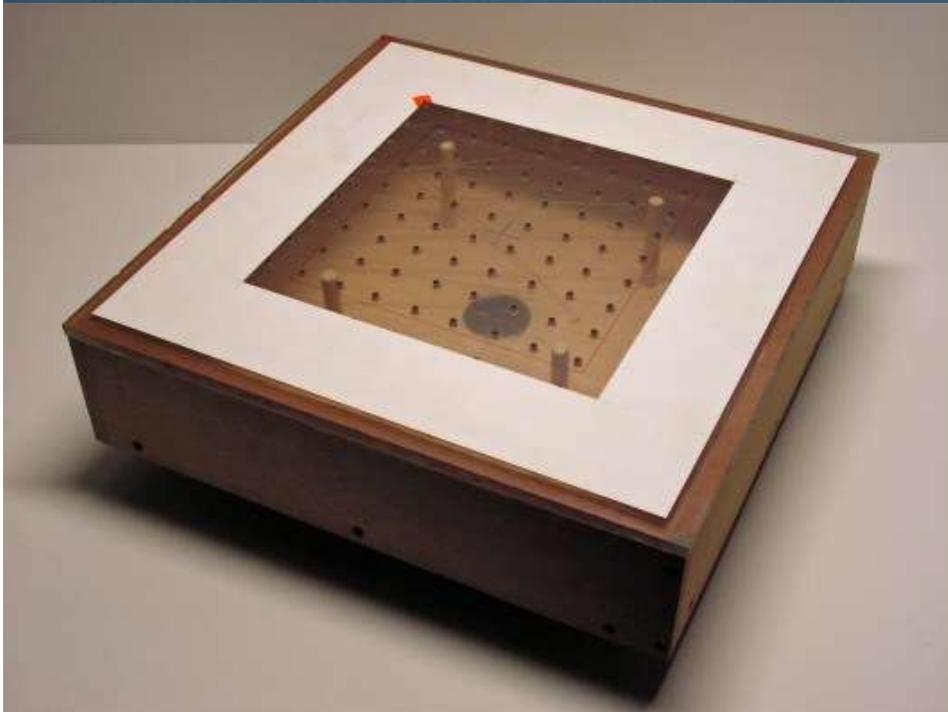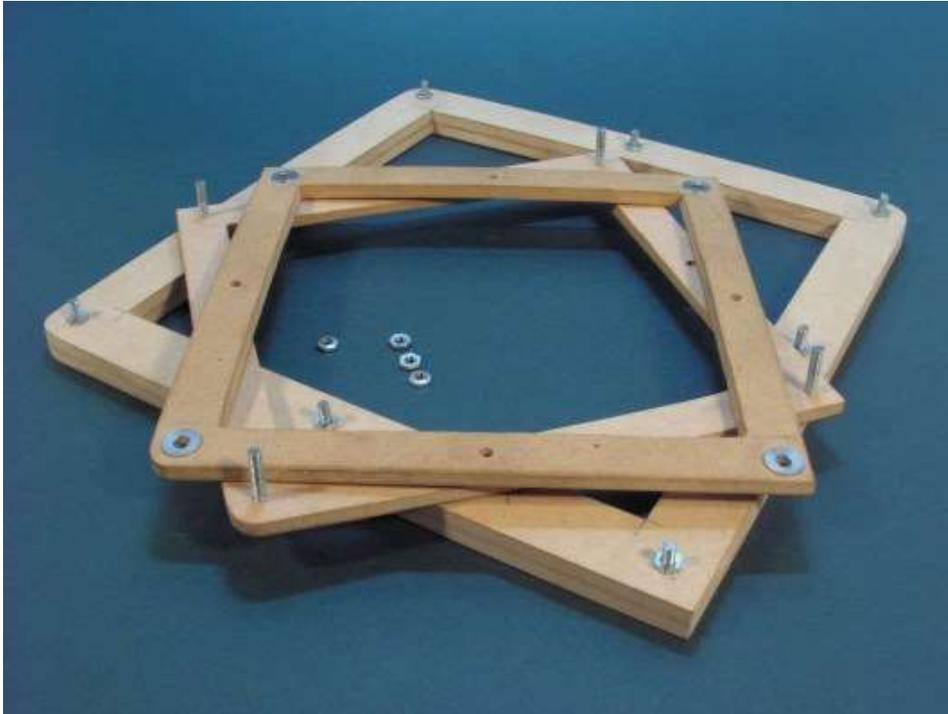
Master Pattern - these can be made from virtually any material you are comfortable working with. Most *Master Patterns* I use are made from MDF blocks cut, carved and sanded to the required shape. The pattern does need to have a smooth finish with no undercuts.
One thing to remember with vacuum-forming is that you can **not** get sharp edges (corners).
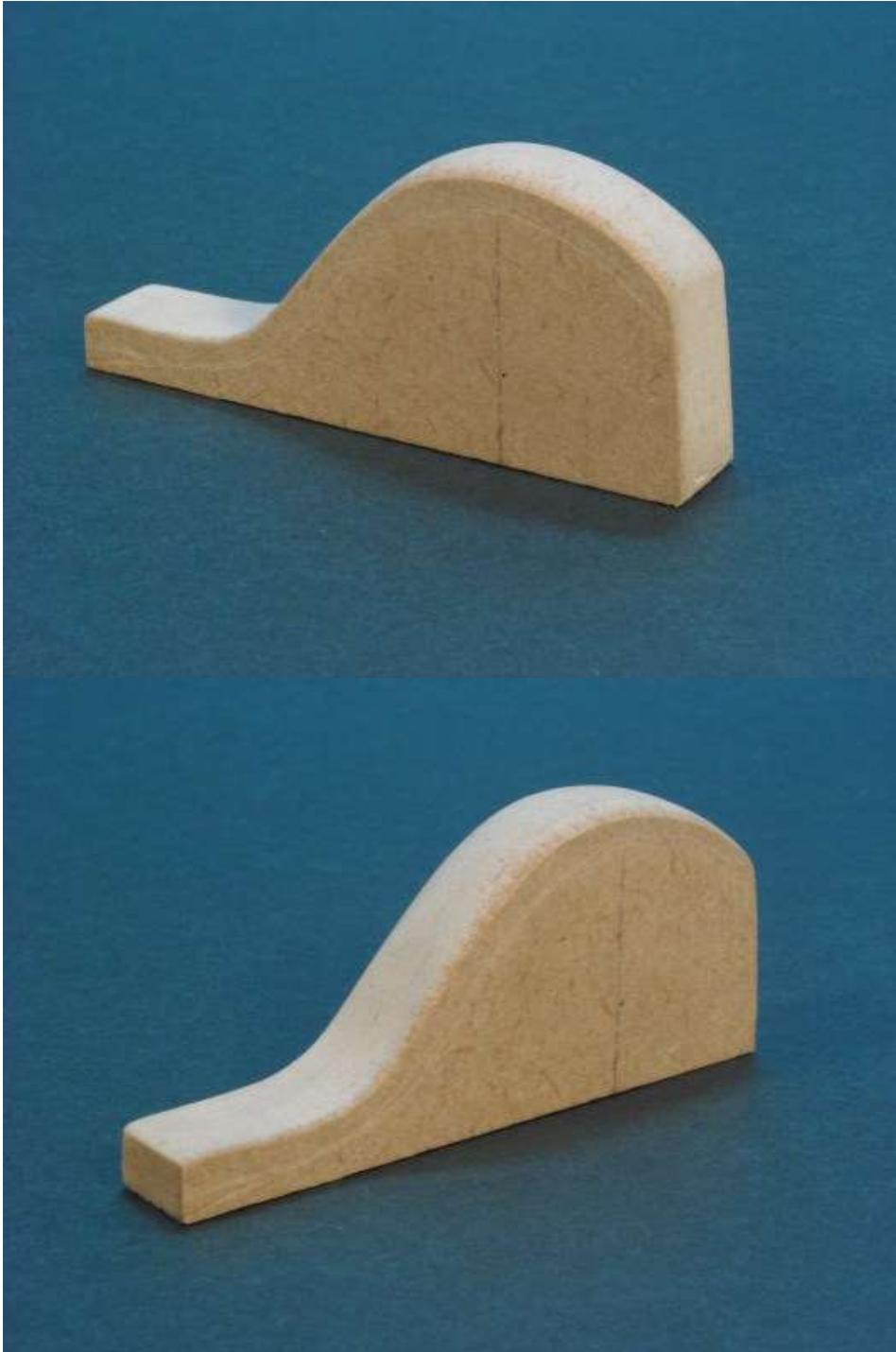
Sheet plastic - before beginning, ensure you have a good supply of sheet plastic. For most vacuum-forming tasks I use .75mm (.030") or for large patterns I will use 1.0mm (.040"). I purchase the large commercial sheets 1500x900mm (5x3') from a local plastics company and is far cheaper than using Evergreen or Plastruct sheet. When buying, let the supplier know what you intend to do with it as some types of plastics are less suitable for home vacuum-forming (ABS Butyrate, Copolyester) the type I normally use is HIP (common styrene).

From experience I have found that .75mm (.030") plastic sheet after forming will give a wall thickness of approx. 0.5mm (.020") and 1.0mm (.040") gives a wall thickness of approx. 0.75mm (.030"), this is dependent on the overall size of the intended piece

The Process.

Once we have made our *Vacuum Box, Sheet Frames* and *Master Pattern* it's time to put the theory to the test,

1. Pre-heat the oven to 175degrees Celsius (347degrees Fahrenheit)

2. While the oven is warming setup the *Vacuum Box* and Vacuum cleaner as close as safely possible to the oven with the *Master Pattern* centred on the box

3. Place the sheet plastic (in its frame) in the oven on some raising blocks (fire bricks/green wood) this is to allow for the heating sag.
    Also place a large tray on the bottom rack, just in case the plastic "gets away" (becomes molten).