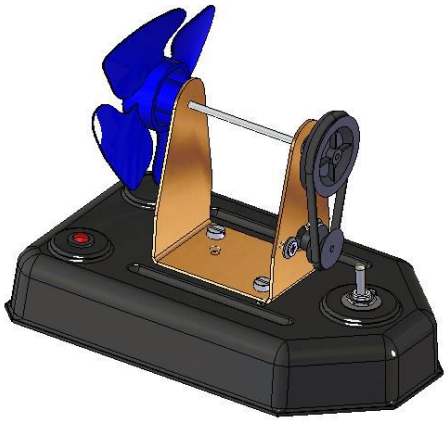
Design for Manufacture



Design and Manufacture a Working model Electric Fan.
Your design must be manufactured using the materials supplied and incorporate the following:

A vacuum formed secure base that will support the fan and house:

- A switch & 3 volt battery
- Associated speed control and a power on/off LED indicator.
- Have a means of supporting the motor or a brass support bracket that will position the motor, drive pulleys and drive shaft in appropriate positions securely to accommodate a speed reduction.

The student may be given the following materials.

1. ***Diameter 8mm x 100mm brass rod or Brass Strip 164 x 30 x 1mm.***
2. ***MDF board 140 x 70 x 24mm.***
3. ***Electronic / mechanical components for their design.***

All electrical connections should be soldered. Each student should individualise his/her design.

The rational behind this project is to present a plan that may assist the teacher in managing the manufacturing and design process in a Technology Room. The constraints placed on the teacher will be material available and cost, the machines and tools available and time allocated to manufacturing the project. All students should experience a successful outcome to their project and the better student has scope to develop further enhancements to their design.

Remember "Design is not always about inspiration and genius" is more about "Perspiration and hard work"

The student should be required to make a “mock-up” model of their design as a homework exercise to test proportion & function. Light cardboard sheet and tube, masking tape, thumb-tacks, cocktail sticks and Blue-tack may be used.
This provides the opportunity for the student to refine or modified their design before moving on to expensive materials and wasting valuable time on a shape that may not have a successful outcome.
Each piece of material used in a design should serve at least two functions to reduce the number of parts required.

From the Brass strip the student must design a support bracket to hold the motor and drive mechanism in the appropriate positions;

- The student must measuring the motor to establish distances and drill hole diameters before marking out the bracket.
- The bracket shape and method of attaching it to the base also gives the student the opportunity to personalize their design - see sketch page for possible solutions.
- The bracket should be de-burred and polished before bending.
- To further develop the project for the better student the rotor may also be designed and made from brass.

Further advanced Design Options for this Project

- **Design and make a brass fan rotor to replace the “bought in option”.**
- **The brass cone may be made on the made on a CNC lathe.**
- **The Brass Cone is Screwed & Tapped M5.**
- **The fan is soldered to the brass cone.**
- **Gear or chain drive may be used.**
- **A mechanism designed to allow the fan to oscillate.**
- **Reversible DPDT ‘Centre Off’ switch is fitted.**
- **Red/Green LED fitted to indicate forward / reverse operation.**

N.B. The speed control circuit / drive may be recycled for use in any motorised project.

Desk top Fan Project - Material List

Item	Quantity	Description	Rapid Electronics Ref Code
1	1	MDF board 140 x 70 x 24mm	
2	1	Polystyrene sheet x 2mm V/Forming	4 Moulds per sheet.
3a	1	Brass Strip 164 x 30 x 1mm	Miko Metals
3b	1 (optional)	Brass bar Dia. 8mm x 100mm	Miko Metals
3c	1 (optional)	Motor mount 20mm clip to suit 1.5 – 4.5V motor	37-0360
4	1	Steel bar 50 x 2Ømm chromed.	37-0350 per pk of 50
5	1 of each	Pulley black Polystyrenes 12Ø & 25Ø	37-0375 & 37-0380 Pk of 10
6	1	Polythene Fan 60 Ø mm	06- 0690 or 06-0692 per unit
7	2	Steel self tapping screws No 4 x 6.5	33-3150
8	4	4 Flat steel washers to suit M3.	33-1760
9	2	S/Steel Pan Head M3 x 8.	33-4115
10	2	S/Steel nuts M3.	33-4305
11	1	Miniature Switch SPDT	75-0211
12	1	Miniature high torque Motor 3Volt	37-0144
13	1	Red & Green LED per packet of 100	55-1776 & 55-1772
14	1	Led bezel to suit 5Ø Led	55-0260
15	1	150 or 220 Ω fixed resistor	62-0350 & 62-0354 per 100
16	1	Knob to match resistor spindle 6 Ø mm	32-1200
16	1	22KΩ variable resistor.	65-0502
16	1	Battery Holder 2 x AA = 3Volts	18-0125
17	1	Battery Clip PP3	18-0092
18	1	Length Pulley drive belt	52- 5082

Additional Tools & Equipment Required

Bending Machine, Drill with Stand, Vacuum Forming Machine, Height Gauge
Drill bits 2, 2.5, 3.5 & 4 Ø, Fine water paper, Hand Clamp,
Phillips screwdriver, Pliers, Metal polish & cloth,
Soldering Iron, Solder, Red & Black link wire, Wire Stripers, Super Glue, Stanley knife.

Materials may be purchased from;
Miko Metals; ☎ 021-4966907
Central Technology Ltd; ☎ 01-8223355
Rapid Electronics Ltd; ☎ 0044 -1206 751166

Vacuum Forming

Process

A sheet of thermoplastic material is clamped around its edges and heated until flexible. A heat-proof mould of the required shape is raised into the softened plastic. The air between the sheet and the mould is evacuated by a vacuum pump. Atmospheric pressure then forces the plastic sheet tightly over the mould. A permanently 3-D shape is formed.

The vacuum forming process can be used to make product packaging, speaker casings and even car dashboards.

Normally, draft angles must be present in the design on the mold (a recommended minimum of 3°), otherwise release of the formed plastic and the mold is very difficult.

Vacuum forming is usually – but not always – restricted to forming plastic parts that are rather shallow in depth. A thin sheet is formed into rigid cavities for unit doses of pharmaceuticals and for loose objects that are carded or presented as point-of-purchase items. Thick sheet is formed into permanent objects such as turnpike signs and protective covers.

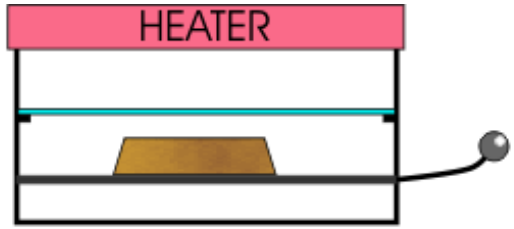
Relatively deep parts can be formed if the form-able sheet is mechanically or pneumatically stretched prior to bringing it in contact with the mold surface and before vacuum is applied.

Suitable materials for use in vacuum forming are conventionally thermoplastics, the most common and easiest being ***High Impact Polystyrene Sheeting (HIPS).*** This is molded around a wood, structural foam or cast/machined aluminum mold and can form to almost any shape. Vacuum forming is also appropriate for transparent materials such as acrylic which are widely used in applications for aerospace such as PCW (passenger cabin windows) canopies for military fixed wing aircraft and "bubbles" for rotary wing aircraft.

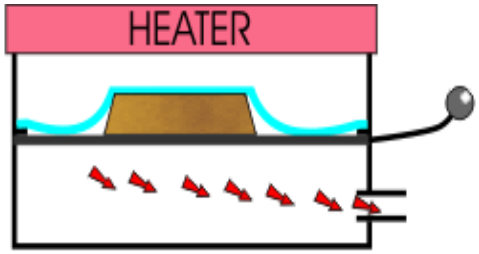
Vacuum Forming Tips & Tricks

1. **MDF & 3mm plywood sheet are cheap and suitable materials used for manufacturing Moulds.**
2. **Complex shapes can be built up in layers.**
3. **Two sided tape, coins, dowels, metal crests, car badges, superglue, wood fillers, matches may be used to enhance or personalize a mould.**
4. **Hole saws, counter sinking bits, counter boring bits, sanding blocks.**
5. **Existing shapes may be filled with patching plaster to make a mould.**
6. **Internal holes cavities in a mould must have 2 Ø mm holes drilled through to the base of the mould to all the cavity to emptied by the vacuum pump.**
7. **Large or complicated shape may be dusted with talcum powder to assist in releasing them from the mould.**
8. **The base of the mould may be drilled and treaded M6 to allow a handle to be attached to pull the mould from the formed shape.**
9. **Do not over heated the plastic sheet as it will sags and this increases the like-hood of webs between moulds.**
10. **Well designed pattern with smooth finish are easily removed from the finished vacuum form.**

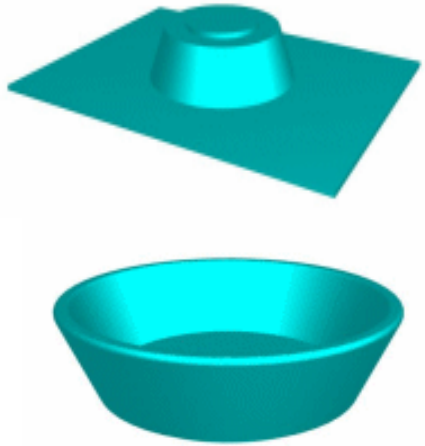
Steps in the Vacuum Forming Process



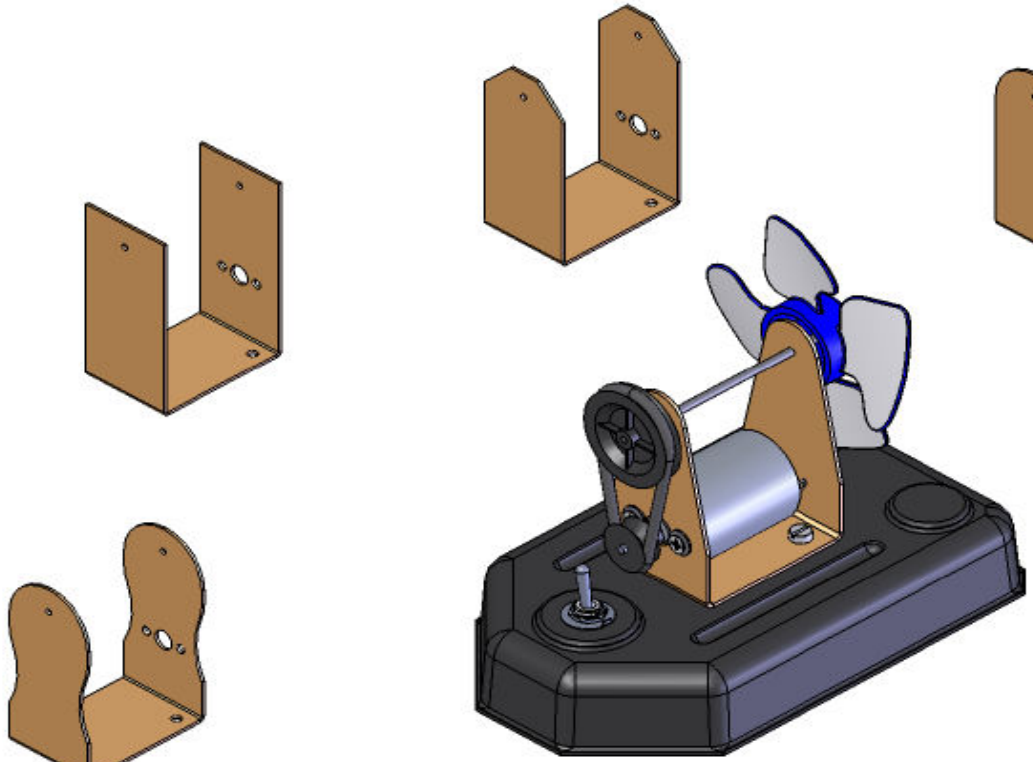
PLASTIC SHEET IS PLACED ABOVE THE MOULD AND CLAMPED SECURELY.



THE AIR IS PUMPED OUT OF THE AREA BELOW THE PLASTIC AND MOULD.



Examples of Student Projects - Vacuum Forms used to house Electronic Projects.



Desk Fan

A Variety of Different Solutions to Design Problem

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DESIGN & COMMUNICATION GRAPHICS

TITLE: Alternative Design Solutions

DRAWN BY: YOUR NAME HERE

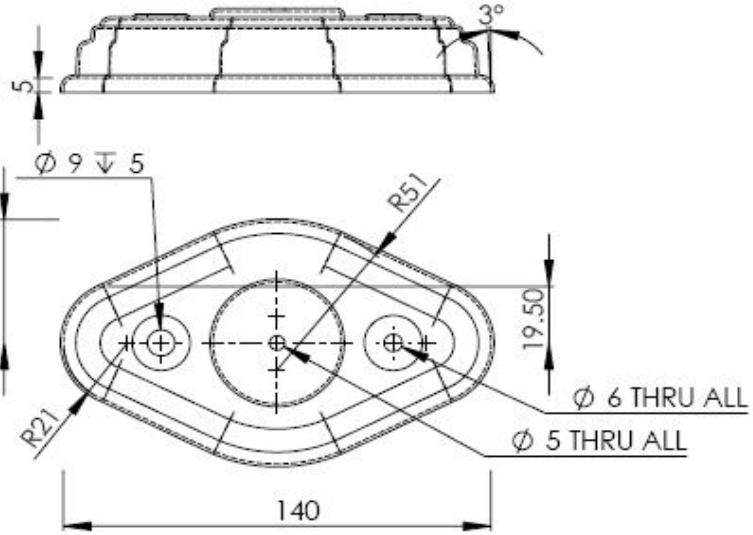
SIZE A3

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN mm

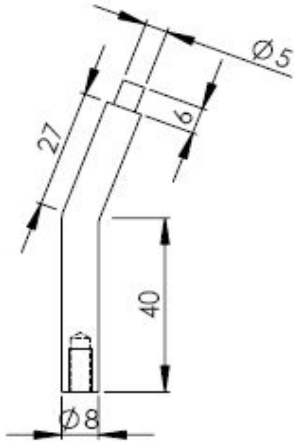
SCALE: 1:1

DATE: 31/01/2008

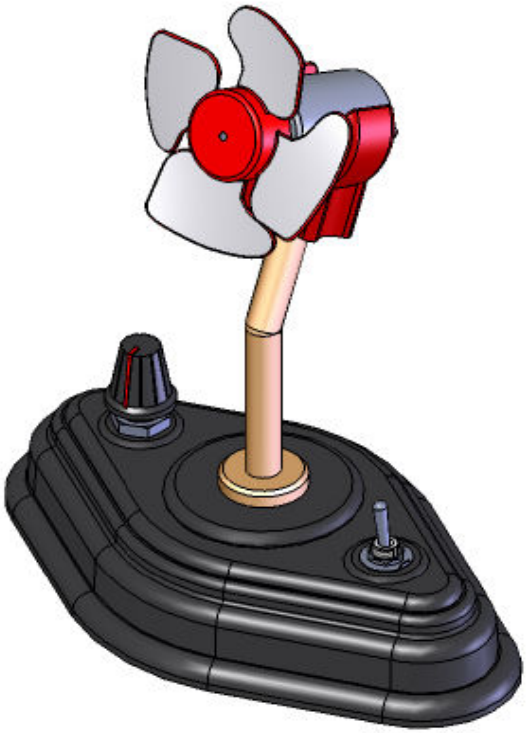
SHEET 1 OF 1

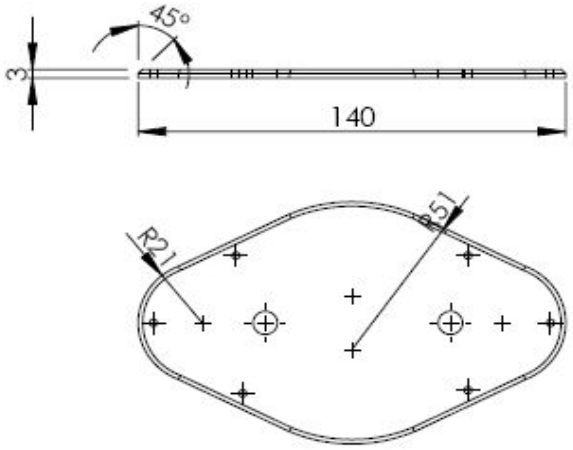


1. Base

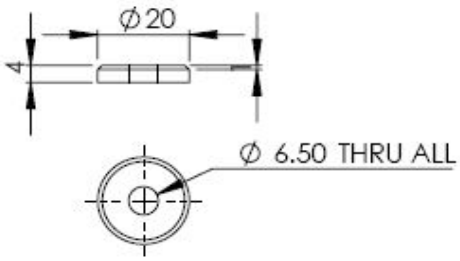


3. Motor Holder





2. Base Cover



4. Brass Washer

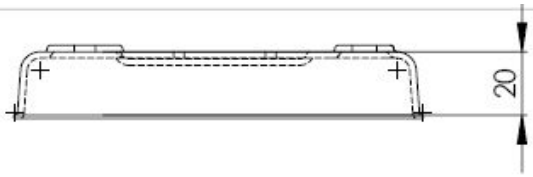
TECHNOLOGY SUBJECTS SUPPORT SERVICE

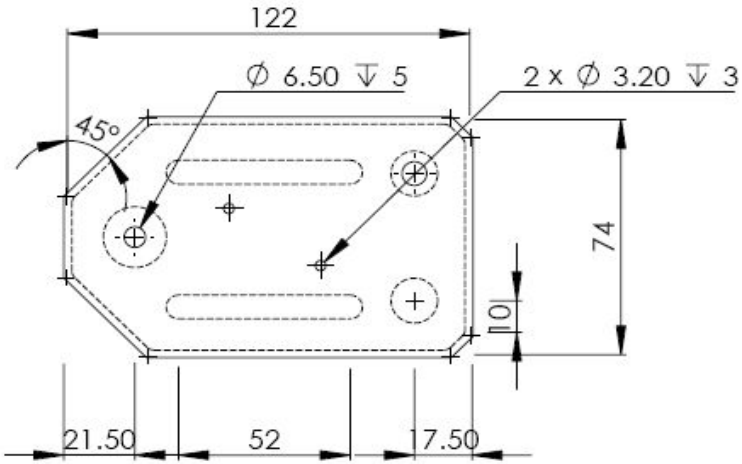
DESIGN & COMMUNICATION GRAPHICS

TITLE: Desk Fan 2

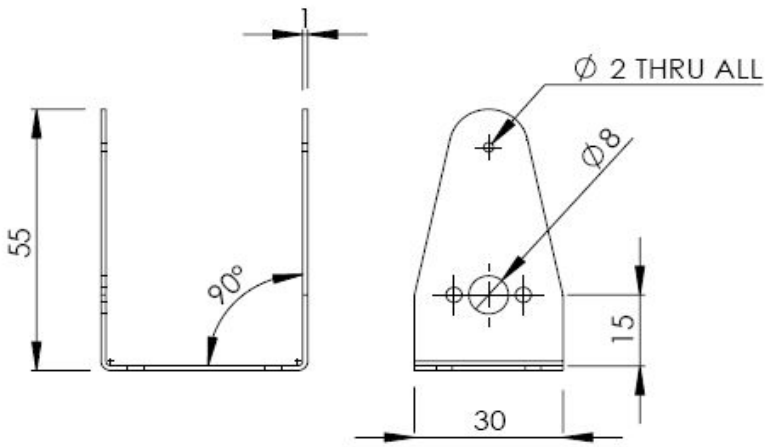
DRAWN BY: YOUR NAME HERE | SIZE A3 | UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN mm

SCALE: 1:1 | DATE: 01/02/2008 | SHEET 1 OF 1

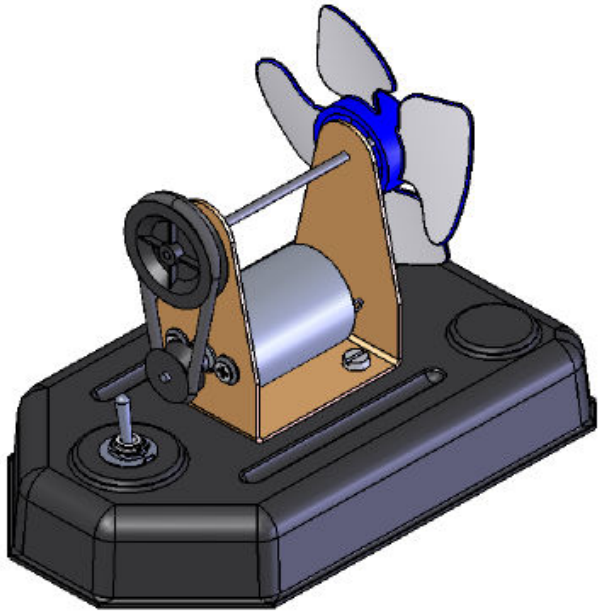




1. Base



2. Motor Holder



Desk Fan

TECHNOLOGY SUBJECTS SUPPORT SERVICE

DESIGN & COMMUNICATION GRAPHICS

TITLE: Desk Fan

DRAWN BY: YOUR NAME HERE | SIZE A3 | UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN mm

SCALE: 1:1 | DATE: 31/01/2008 | SHEET 1 OF 1