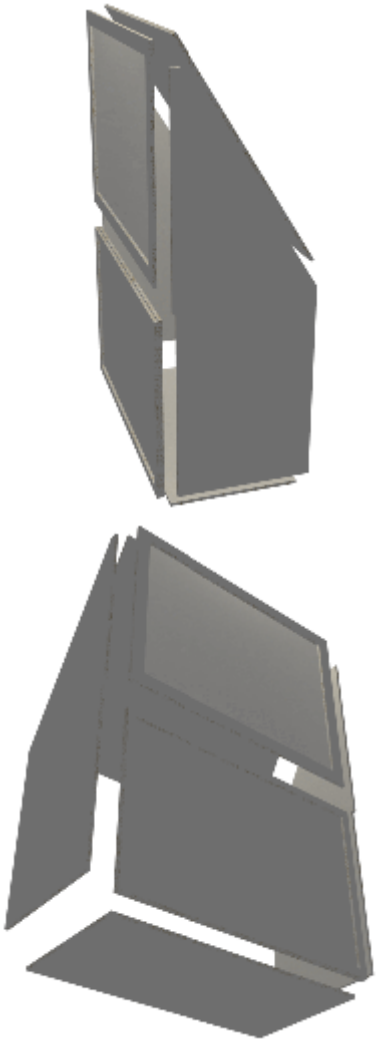
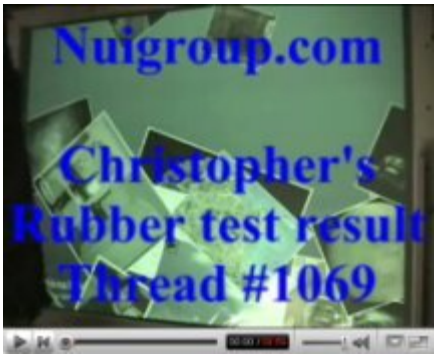
Christopher's Multitouch screen Plans

During my spare time, I have built a nice multitouch display. In this article, I will share plans and explain how to construct a 56 inch multitouch screen that looks like a TV. It's not an easy setup and it's not suitable to be commercialized but for personal use it's fine to test new soft.



Here's 2 of my video to show my result

http://www.youtube.com/watch?v=tCwn0FwWh3

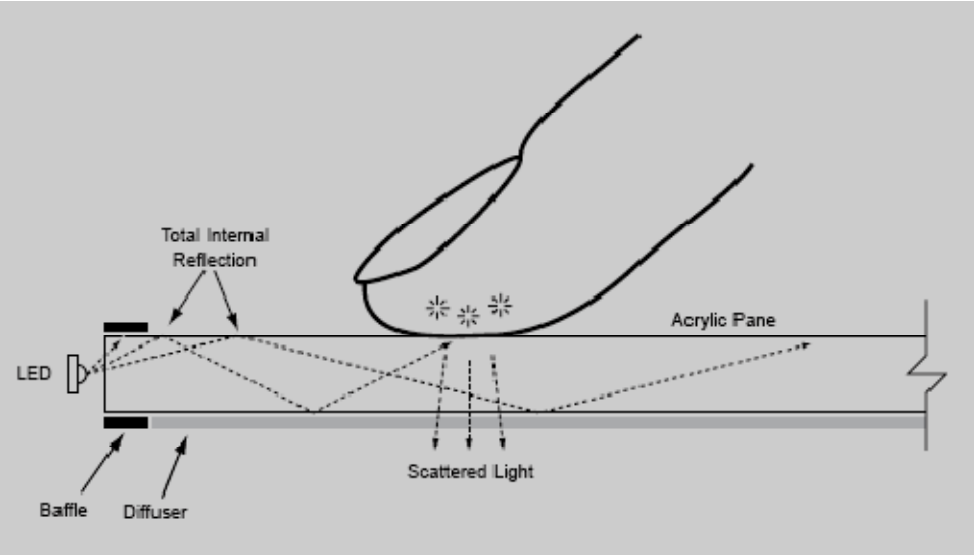


http://www.youtube.com/watch?v=Wi8DqXYYehE

Basic Principle

Frustrated Total Internal Reflection

- When light encounters an interface to a medium with a lower index of refraction (e.g. glass to air), the light becomes refracted.
- The extent of refraction depends on the angle of incidence, and beyond a certain *critical* angle, it undergoes *total internal reflection (TIR)*.
- Fiber Optic cable is a common technology that employs TIR.
- However, another material at the interface can *frustrate* this TIR, causing the light to escape the waveguide there instead. Ref : http://www.cs.nyu.edu/~jhan/ftirtouch/



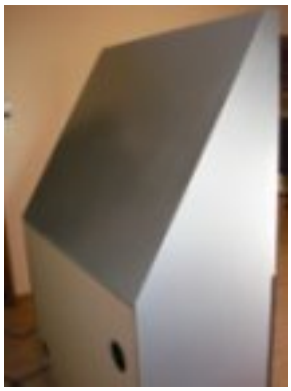
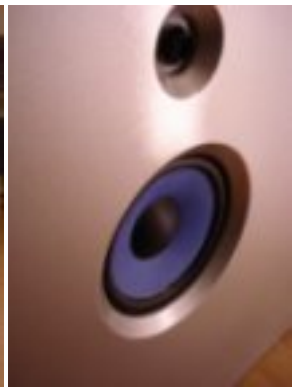
Under "ordinary conditions" it is true that the creation of an evanescent wave does not affect the conservation of energy, i.e. the evanescent wave transmits zero net energy. However, if a third medium with a higher refractive index than the second medium is placed within less than several wavelengths distance from the interface between the first medium and the second medium, the evanescent wave will be different from the one under "ordinary conditions" and it will pass energy across the second into the third medium. (See evanescent wave coupling.)

A transparent, low refractive index material is sandwiched between two prisms of another material. This allows the beam to "tunnel" through from one prism to the next in a process very similar to quantum tunneling while at the same time altering the direction of the incoming ray. Ref: Wikipedia

The principle is to modify a webcam to allow it to capture only IR light and point it to your screen. Then the software analyzes the images and detects press where there is a blob. A blob is the light projected back of your screen when you press onto it (Scattered Light on the schema).

My construction



Material needed

-Computer
-Projector
-Webcam
-Special lens
-IR Filter
-36 x 48 inch Plexiglas ½
-36 x 48 Rosco Gray Rear-Projection Screen
-168 Osram SFH485 880nm IR LEDs
-Wire and resistors
-Silicone
-Toluene
-Protective foil
-Mirrors
-Tapes
-Glue
-Black paint
-Mdf, hdf or plywood sheets
-Front speaker fabric
-Many different tools
-screws
-wood finishing product
-paint filter
-paint can

Silicone rubber

The silicone rubber layer helps coupling between the Rosco projection screen and the acrylic. It allows the user to have brighter blob for less pressure onto the screen. Without it users should have to press really hard to get decent blob.

You can watch a video that illustrate the differences at:
http://www.youtube.com/watch?v=btOhSoCTHFI

Product preparation Material needed

	**Dap 300ml Draft attack removable caulk** **Or DAP® SEAL 'N' PEEL® Removable Caulk** **Where to find** **http://www.dap.com/find_a_retailer.aspx** **Lexel silicones are also toluene base.** **Any silicone who is toluene base will give great result.**
	Toluene is a common solvent, able to dissolve: paints, paint thinners, many chemical reactants, rubber, printing ink, adhesives (glues), lacquers, leather tanners, and disinfectants. You will find toluene in any good paint store.
	Empty paint can You will find paint cans in any good paint store. Or you could check this link: Empty paint cans

Product preparation 3 steps preparation

	First step: Put silicone in the empty paint can using a caulk gun.
	Second step: Put toluene in the can. From my experience, two tubes of caulk will require to fully load the can with toluene. So one tube should require the half. Start with less and ad more to obtain the good consistency.
	Third step: Mixing... Not too many things to say about it… Shaking is the best, if you have access to paint shaker, it should help you for this step…
	Final result It should look like this when it's totally dissolved.

Now the product is ready, you can apply it with the pouring method or you can use the spraying method.

If you choose the pouring method please check this video:

http://www.youtube.com/watch?v=bnjeWbvVCC

Thanks to Blaxwan

Vaporization Material needed

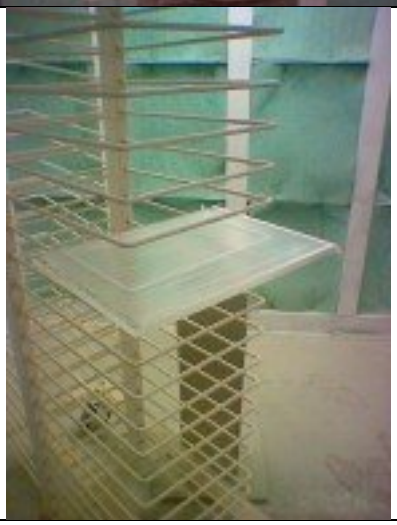
	Hvlp spray gun This is the best choice to do this job but it will require an air compressor. Search eBay for hvlp spray gun Don't buy those mini hvlp, the stuff dry too fast it's hard to do a good job. I've found many hvlp gun for 30$ shipping included. Or
	Electric spray gun I have not tested this kind of spray gun but I think it should do the job and it doesn't require an air compressor. Search eBay for electric spray gun I've found many for 15$ shipping included.
	Paint filter You should find paint filters in any good paint store.

Now if you have your spray gun and your rubber mixed, you are ready to spray your rubber over your acrylic. You should find a well ventilated place where you will be able to spray your coating. You can spray it outside but try not to do this a windy day to avoid unwanted particles to stick onto your surface.

Safety

Toluene is a solvent, it's highly inflammable. Like many varnish or stain you should apply it in a well ventilated place…

Vaporization Six steps application

	First step: Prepare your acrylic. If it's a used acrylic, wash it vigorously with toluene. If it's new, remove the protective only and don't wash it or touch it (it's the best). I put tapes around the surface because I don't want rubber on the last ½ inch edges.
	Second step: Filter your rubber and fill up your spray gun with the mix.
	Third step: Spray your surface. Try with toluene onto paperboard to practice. Apply many small layers rather than one big or the product may ripples. Let the layer dry one or two minutes before spraying the other.
	Fourth step: Let the product dry for at least 24 hours.

Vaporization <u>Six steps application</u>

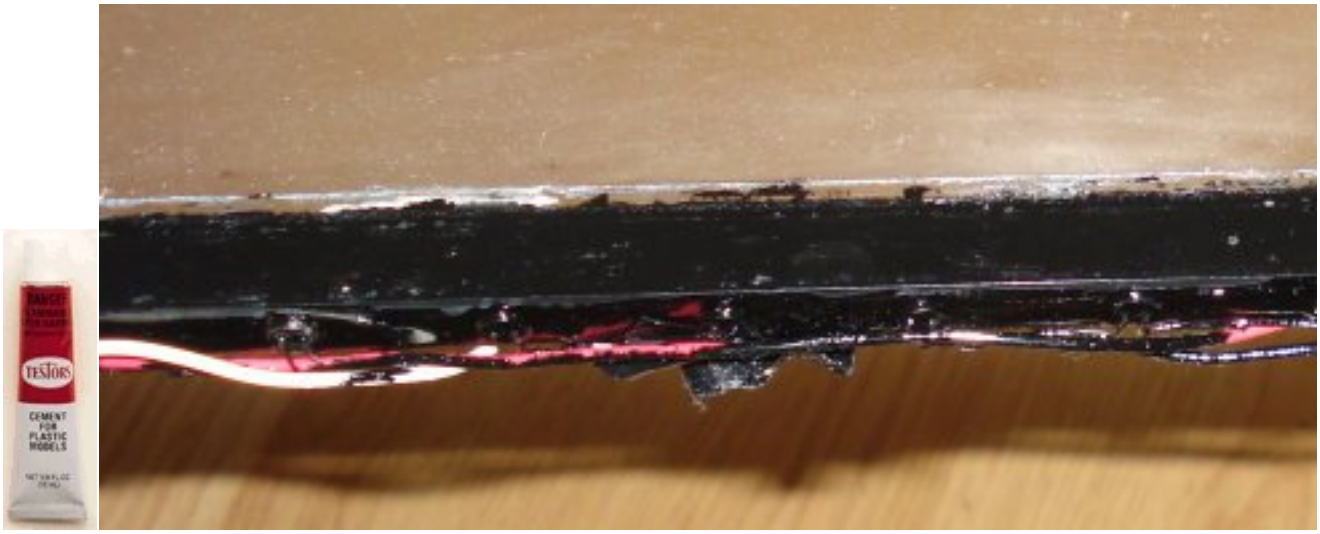
	<u>Fifth step:</u> Cut along the tapes before removing the tapes or the rubber layer may follow. I use my nails to prevent scratching the acrylic.
	<u>Sixth step:</u> Remove the tapes.
	If you ever do a mistake, you will be able to remove the rubber layer but you will have to wash seriously your acrylic with toluene.

FAQ

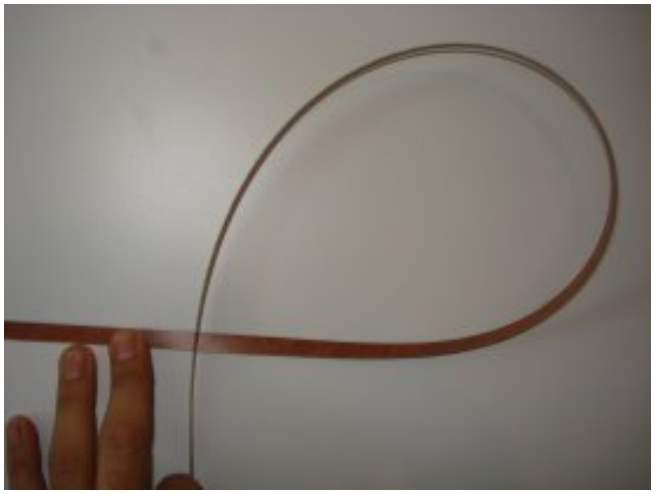
1- You don’t need both spray gun and it may be different from my picture.
2- You are not obligated to put tapes around the edges.
3- If you remove your rubber layer, wash seriously with toluene or the next application won’t be good. You will have spots where the ftir effect will be visible.
4- If you have “fish eye” spot when spraying, your mix is contaminated. Wash seriously your stuff and check for the contamination source.
5- You should always be the most cleanly as possible. Wash everything.
6- It’s not necessarily an easy solution but playing with spray gun is cool.
7- You can use the pouring method
8- There’s many other rubber that can be spead

Ir leds

In this setup I put one led every inch on four side of the acrylic. 36x2+48x2= 168 led. Big quantity of leds helps to have really bright blobs. For my experience 1 led every inch is enough to get nice result. I got the best performance by drilling 5mm holes on side of the acrylic and then glued them with testors glue. Then I wired the leds and paint the acrylic edges using really dark black paint. I don't use any frame on side of acrylic, black paint block all IR and it's a lot simpler to avoid leaking of IR.

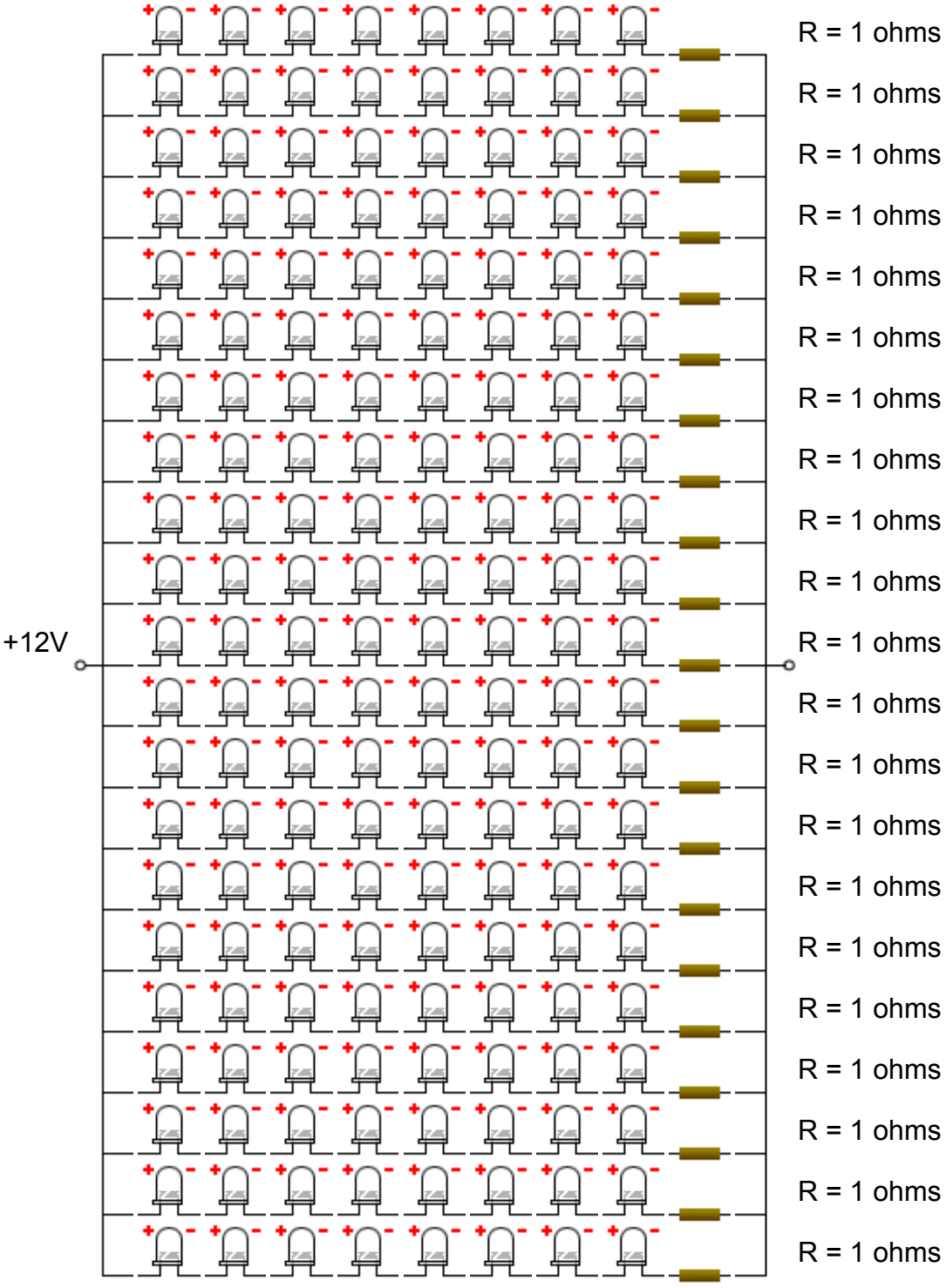


Your acrylic is now ready to be covered with other layers. Before you stretch the Rosco on the acrylic you have to put a 1mm spacer on edges of the screen to avoid the Rosco being directly on the silicone rubber. I personally use arborite which is



This small air gap helps to avoid the Rosco from sticking to the acrylic.

Wiring diagram



- each 1 ohm resistor dissipates 10 mW
- 1/4W resistors are fine
- together, all resistors dissipate 210 mW
- together, the Osram dissipate 25200 mW
- total power dissipated by the array is 25410 mW
- the array draws current of 2100 mA from the source

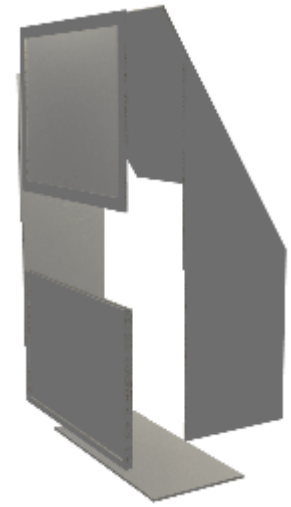
Fixing other layers

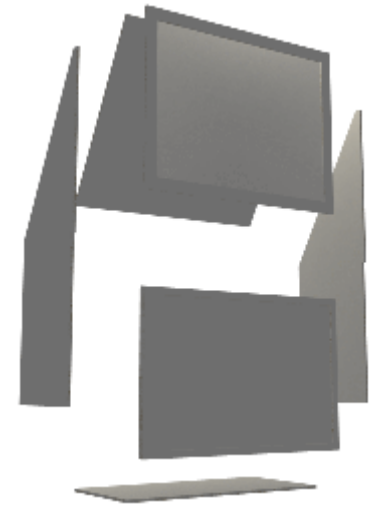
The easiest solution I find out to this problem its tape, I used the best tape I found. For the simplest result you start by stretching the center in both directions horizontally and vertically and then you process to the outside in rotation. Go by small steps to avoid wave in foil. First you have to stretch the Rosco than your protective foil. I use to cut both exactly the same dimensions of my screen so it simple to tape it on edges and at the backside.

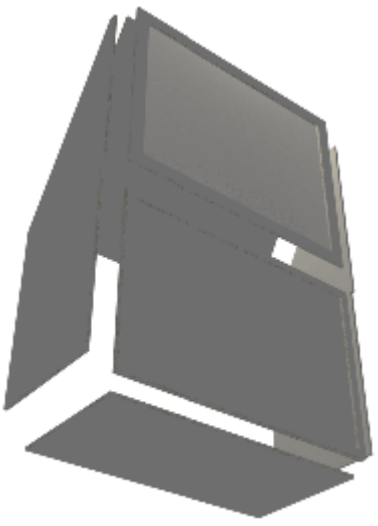
Similar product as my protect film

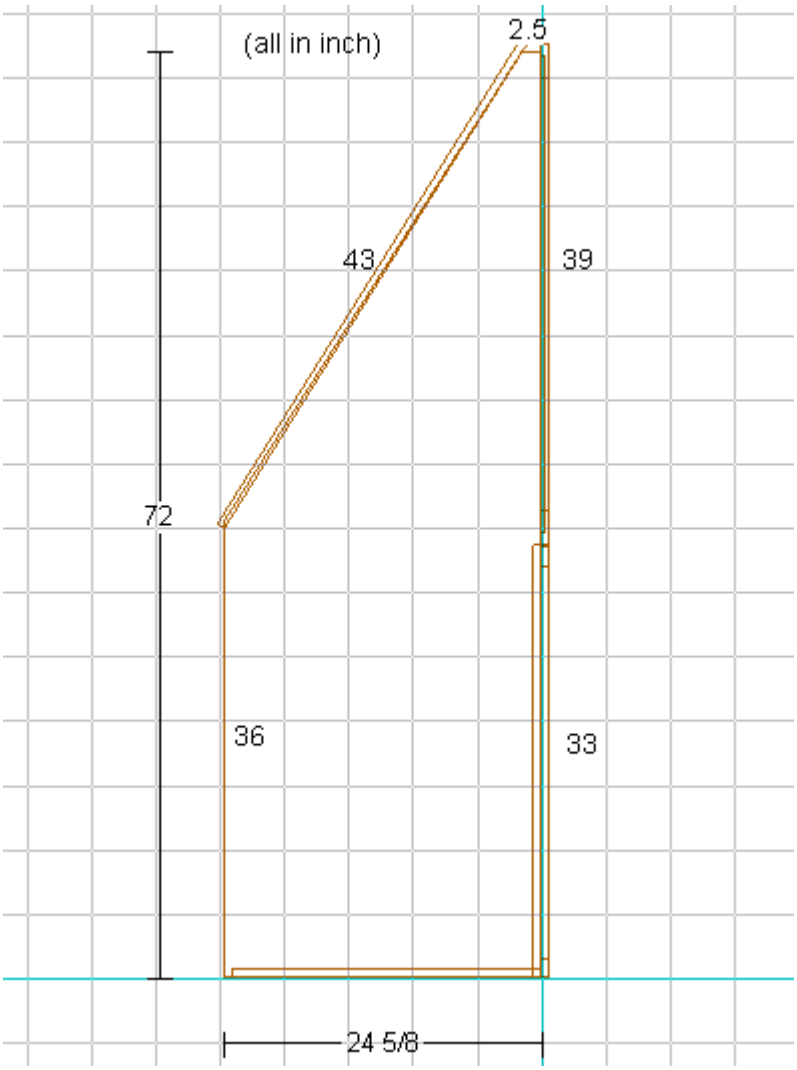
As protective foil I personally use Insulating film which are really thin and retract when you blow warm air onto it. You have to stretch it using the same method as the Rosco and then you blow warm air from an air dryer to eliminate waves. My results with this product were awesome compare to those obtain with my previous vinyl which was too thick and hard to hold with tape. I suggest you to put some layers of tape around the edges of the acrylic to help other tape to hold.

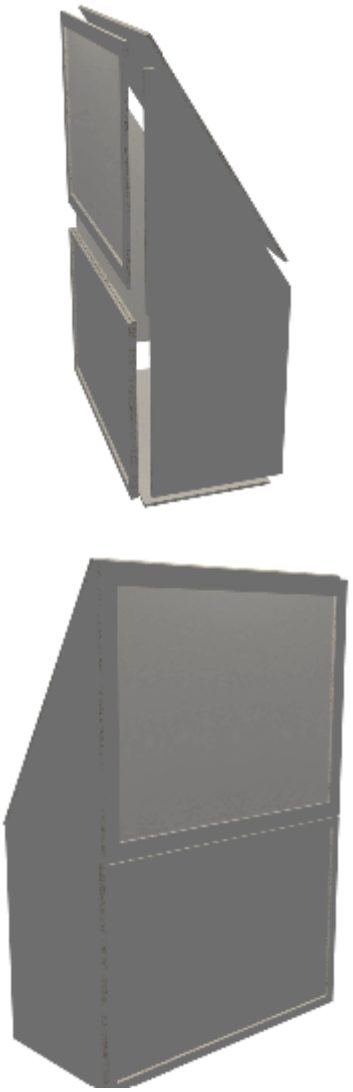
The box Plans











I will not explain process to make this box as long as it's simple carpentry and if making this box is a problem you will find a lot more information on this website:

http://www.woodworking.com/dcforum/dcboard.pl

Position of components